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LEVEES, OUTLETS AND RESERVOIRS AS MEANS FOR PROTECTION AGAINST OVERFLOW OF THE ALLUVIAL LANDS OF THE MISSISSIPPI VALLEY BELOW CAIRO.

THE alluvial valley of the Mississippi River below Cairo contains 29,790 square miles of land subject to overflow in its natural state. It is all capable of protection and reclamation by levees except a small area at the foot of each closed drainage basin, which must be left open for the escape of surface water, and a fringe of sea marsh along its southern border. It has been in course of progressive reclamation by that method for nearly two hundred years. For the last twenty years the United States government has been assisting in the work and its progress has been rapid. The existing lines of levee are about 1,350 miles long. About 80 miles remain to be constructed to complete in length the main river system, not including some areas so small that they are not worth the cost of reclamation at the present time. In only a few places, however, are the embankments as high and strong as they should be for the greatest safety. It is not known, in fact, just how high they ought to be in order to accomplish that purpose. The work of building them began at the lower part of the river and has been carried up stream progressively. As they advanced they confined within the channel more and more of the water of great floods which had previously escaped over the bank and made its way to the sea by other paths. This process raised the flood levels within the levees higher as they were extended up

stream, and they had to be raised and strengthened to meet the added load. These additions were made as the need of them developed. These needs were forecast from time to time as nearly as possible. It was a difficult problem. The 'potential high water' of floods to come has been the subject of much study and discussion. The nearest approach to a standard has been that the levee should be three feet above the highest previous flood line in that locality. In order to ascertain this line it has been the practice to record extreme high-water levels by marks on trees at intervals of a few miles along the bank. These records show such irregularity of behavior in the great floods as to make it necessary to fit the grades of the levee to local conditions. One element of disturbance and uncertainty yet remains in the completion of the closure of the St. Francis front, where about 60 miles of embankment remain to be built. That great basin, 6,700 square miles in area, has exercised in the past a profound influence on the channel along and below it. In its natural state it received a vast volume of overflow which it returned to the main stream again at and about the mouth of the St. Francis, immediately above Helena. This abstraction of water from the river along the upper and central portions of the front of that basin weakened the stream and so tended to shrink the channel in those parts; while its return at the foot of the basin augmented the stream, with a resulting tendency to enlarge the channel. Consequently, when we come to confine the flood discharge by levees along the St. Francis front, the water, in passing down, finds a channel of more ample dimensions in the neighborhood of the foot of the basin than that which it finds above. It is to be expected, therefore, that a great flood will reach a higher elevation in those parts of the channel where, for ages past, the flood volume has been depleted by overflow than in those parts where, during the same ages, the flood volume has been augmented by return of the overflow.

Still other circumstances enter in to complicate the problem, so that, upon the whole, only the actual confinement of a series of great floods without a break from Cairo to the sea will give us the ultimate high-water profile.

But we are making rapid progress toward that information. The great floods of 1897 and 1903 carried more water to the sea between banks than any of their predecessors. They have left records of gauge readings and discharge measurements which afford a great field of interesting study into which I can not enter within the time and space at my command. Those limitations will permit only the briefest summary of what the levees accomplished and what they failed to accomplish toward the protection of the lands behind them. They were floods of the first rank and may be taken as typical of what may be expected to occur at intervals of a few years in the future.

The flood of 1897 made 38 crevasses, having an aggregate width of about 8 miles; the flood of 1903 made 9 crevasses, having an aggregate width of about 3 miles. The levees in place in 1903, if no crevasses had breached them, would have protected about 26,000 square miles from overflow. Of that area a total of about 3,000 square miles was overflowed in consequence of the crevasses which took place, which is less than one eighth of the entire area which the existing levees could and would have protected if they had all been high enough and had held their places. In the phrase of the target shooters, they accomplished 87½ per cent. of success out of a possible 100.

These experiences indicate that with complete restraint of the floods by levees we shall have, as an immediate result, some further elevation of the maximum flood

level; but not very much—not enough to change any element of the problem, nor to introduce into it any new difficulty except the additional expense necessary to build and maintain the embankments at the higher grades required. The levees have done their work so well and are so far advanced toward completion that the abandonment of that system for an attempt to protect the alluvial lands in some other way is not to be considered for a moment. The interests involved are too vast to be put in jeopardy by experiment. To complete the existing system and maintain it is a duty so plain that it is not open to discussion. At the same time there is no reason why the believers in outlets and reservoirs should not continue to advocate their theories, nor why their arguments should not receive the compliment of polite refutation. There is still great lack of information on the subject in the public mind. The government has spent large sums from the United States treasury in aid of levee building, and must continue to do so if they are to be perfected and maintained; and all citizens who care to look into the subject are entitled to know why that method of protection has been and is to be pursued instead of others that are proposed.

Nothing could be more natural than the suggestion to seek relief from great floods by providing additional channels for the surplus water; and it takes some close consideration of the subject to perceive the fallacy of the proposal. But it is, as I shall attempt to show, a delusive scheme as a means of protection against overflow of general permanent practicability and utility. In the consideration of the subject I shall try to come a little nearer to it than has been heretofore attempted, so far as I know, by locating an outlet system on the only lines upon which it would be available for the advantage of the alluvial valley as a whole, and discussing its feasibility and utility from a practical standpoint. I have indicated such a system by the continuous red lines on the accompanying map. The broken red line is to be disregarded for the present.

Such a system would necessarily begin in the St. Francis basin. Suppose we should make a group of outlets near the head of that basin and connect them with a channel of sufficient capacity to carry, say, one tenth or one fifth of the combined discharge of the Ohio and the Upper Mississippi during great floods. The water thus diverted would be returned to the main channel at the foot of the basin, and would produce a flood height there as great as though the same water had come down the main channel. What should we do with it there?

A possible answer would be to make another outlet on the other side of the river into the head of the Yazoo basin, with a channel of like dimensions down that basin to its foot at the mouth of the Yazoo. To follow up the plan it would be necessary to make a third outlet, leading this time into the Tensas basin, with a channel leading down that basin across Red River and through the Atchafalaya basin to the gulf. We would then have two rivers from the head of the St. Francis basin to the sea, of which one would cross the other twice as a canal sometimes crosses a river in a pool raised by a dam. Those parts of the river in the neighborhood of the crossings would have to carry the whole flood volume and would require levees as high as, or higher than would be required in a levee system without outlets.

Such a combination would be enormously expensive. The secondary channel would be not less than five hundred miles long. In order to carry water enough to afford substantial relief from floods of the first magnitude it would need to be of large capacity. It would pass through the central parts of the fat alluvial basins. To dig

it, with all the use that could be made of existing streams and bayous, would require the removal of earth enough to build several times its length of levee. Nevertheless, with men and money and time enough it could be done. And if it were constructed, and in order at the oncoming of a great flood, I should suppose that for once it would materially lower the high-water elevation except in those parts of the river in the neighborhood of the crossings of the main river by the subsidiary channel. So far up and down stream as that engorgement extended it would be necessary to maintain levees high enough to take care of the water, to whatever stage it might go.

It would be the extreme of folly, however, to construct so costly a work without the assurance of its permanent utility. The probability of this result may be considered from two hypothetical points of view. From the first of them would be contemplated, I may say, a subsidiary channel sufficient in capacity to carry only a small part of an extreme flood—just the two or three feet on top which produce the greatest strain and danger under present conditions. Such an outlet opening would have to be very carefully constructed and guarded, in order to prevent its indefinite enlargement; but that could be done. For that purpose it would be desirable to take the water off through a number of small openings leading to the subsidiary channel as indicated on the map.

The extreme floods which this provision would be designed to relieve occur only rarely—not oftener, upon an average, than once in five years. During the intervals the unused channel, especially those parts of it not following the channel of some river or bayou, would be filled with a dense growth of vegetation—willows and cottonwoods, mostly. The floods have no regular periods of return, so that there would be no way to be sure that the channel would be unobstructed except to keep it open and clean all the time. This could be done too, but it would involve an annual expense equal to the cost of clearing a right of way for a railroad from Cairo to the gulf. It would be expected, I suppose, to lay out the subsidiary channel on comparatively straight lines down the interiors of the basins. This would result in a high velocity of flow in them; and this, again, would result in more or less cutting and caving of banks, with the consequent formation of bars. There would be danger that the subsidiary channel would follow the vicious example of its parent and overflow its banks; and to be secure against this danger it would probably be necessary to restrain its inherited propensities by levees.

It follows that, even with this smallest subsidiary channel that would suffice to relieve the tension of an extreme flood, we would have on our hands a work of prodigious magnitude and cost which, at its best, would relieve us of only a small part of our present burdens and dangers. It would be necessary to continue to maintain the levees on the main stream. They would be subject to the same accidents which befall them now. Caving banks would undermine them, and muskrats would burrow in them as now. Considerations of expense would require us to build on as low grades as would be consistent with safety, just as we do now. When a great flood came there would be the same apprehension of disaster, the same necessity for incessant watchfulness, and the same occasional crevasse which attend the floods now. Assuming that our outlets and subsidiary channel were entirely successful in accomplishing the work for which they were designed, we would still be little better off than we are now with the added burden of the enormous cost of the subsidiary system to be carried forever.

This, it is to be remembered, is upon the

assumption that the outlets would be designed to take from the main channel only the surplus of an extreme flood over the discharge of an ordinary flood. To consider the subject from the other point of view referred to, we may suppose the system of outlets and channels already described to be made of sufficient capacity to carry all the surplus water above the overflow stage, so that the levees on the main stream could be abandoned. This would require channels of far greater size and cost. But as the plan would propose to dispense with all levees and so save the cost of them, we may set off that saving against the cost for the present purpose, and confine our attention to questions of maintenance and effectiveness.

In such a system the subsidiary channel would be only another river. In all floods the two channels would divide the discharge between them, and water would flow in both of them all or a large part of the time. Would the river be able to maintain for itself as ample discharge room in the aggregate by a divided flow through two parallel channels as by a concentrated flow through a single channel? To state the question is to answer it. The smaller the channel *by* which a fluid flows the greater, relatively, is the retardation due to friction. A river flows with greater velocity at high stages than at low stages because of its greater volume. A flood divided between two channels would have less power to scour out and keep open the two channels than it would have to scour out and keep open a single channel. The two channels would have a greater tendency to fill up by deposit of sediment than a single channel carrying the whole discharge would have. There can be no dispute over these propositions among engineers.

It is by reason of the immutable operation of these laws that the Mississippi River has made for itself a single great channel from Cairo to the sea. As between two parallel streams produced by division the smaller stream is the weaker. As it shrinks in capacity by deposit, what it loses in volume of discharge the other stream gains. Thus the disparity between them in volume and energy increases at an increasing rate until the smaller channel is obliterated and the larger stream takes the whole discharge. To attempt to fight that tendency toward concentration in so great a river as the Mississippi flowing through a material so easy to erode and so ready to sink would be a futile undertaking.

I have thus discussed two imaginable outlet schemes—one a mere tapping, or bloodletting, operation to take off the top layer of an extreme flood, leaving the levees to take care of all the lesser floods; the other a true subdivision of flow complete enough to obviate the necessity of levees by providing sufficient channel capacity to carry all floods without overflow. It requires, as it appears to me, only a little close attention to the subject to make it apparent that they are both hopelessly impracticable.

In the consideration of the latter of the two plans stated—that one assuming a general abandonment of levees, and a reliance upon outlets and subsidiary channels as sole protection against floods, I have not taken into account the problems which would be presented at the intersections of the subsidiary channels and the main channel, because the argument seemed to me to be sufficient without considering them. I think, also, that it would be sufficient without considering anything but them.

Such an outlet scheme as I have supposed is the fairest one I can think of for illustration. It is not physically impossible. The soil of the alluvial valley can be fashioned in any shape you choose. There is an imaginable sum of money which would do the work. It would be a less violent contradiction of the natural course of

things than any other outlet scheme. The path of the subsidiary channel would lie wholly within the alluvial basin and over ground undoubtedly occupied in many changing locations by the stream, or parts of it, in bygone ages. It would be like what the river does now on a small scale in many places. At every 'chute' there is an outlet from the main stream and a subsidiary channel passing around an island and joining the main stream below. It may be one mile long or twenty-five. The island may be a mere 'towhead,' or it may be large enough to form a county. My subsidiary channels down the St. Francis and Yazoo basins would be only longer chutes.

Another scheme has been proposed, however, which I regard as more impracticable, if possible, than the one which I have described. It is to take an outlet channel across the upper end of the St. Francis basin through Crawley's ridge and thence to the gulf on a line lying wholly west of the Mississippi River. I have indicated one of its suggested locations by the broken red line on the map connecting the points at which it would leave and rejoin the subsidiary channel indicated by the continuous red line.

The first point to be noticed about such a plan is that it would cut off all the western confluents of the main stream below Cairo—the upper St. Francis, White, Arkansas, Black and Red. It would be an intercepting sewer for the southwestern quarter of the Mississippi valley. It would be a great big river. It would require an amount of excavation equal to several Panama canals, and levees nearly as great as those on the main river, in order to enable it to hold its own floods. Men have done a great deal in the way of improving the work of the Almighty in the creation of the earth already, but this would be a more extensive program of reconstruction than any before attempted.

The next point to be noted is that it would permanently lessen the volume of the main stream from the location of the outlet to the gulf. It would do this to the extent of the discharge of the intercepted tributaries plus the volume taken from the channel by the outlet. What that volume would be would depend upon whether the scheme contemplated a mere tapping process, to take off the upper few feet of extreme floods, leaving the levees to take care of all ordinary floods, or such large reduction of volume as would make the levees unnecessary. If the former, then, as I have already pointed out, we should still have 1,400 miles of levee to maintain at nearly the same cost and hazard which they impose upon us now, besides a second river to take care of, with all its vicious tendencies and caprices; if the latter, we would have two Mississippi rivers to be maintained in equilibrium against the forces of nature which tend constantly in such a situation to give to that channel which hath, and take away from that channel which hath not, even that which it hath.

Such schemes necessarily take a man far afield in the domain of speculation, but this much is certain; if it should prove to be impossible to divert enough water from the main stream in that way to prevent the overflow of the natural bank, the project would have failed as a means of protecting the alluvial lands from inundation; and, on the other hand, if such diversion should be found possible and be accomplished the depleted main stream would contract its channel to correspond with its lessened discharge. A river channel through an erosible formation always fits the river as a turtle's shell fits its back. There is no reason why the channel of the Lower Mississippi is larger than the channel of the

Missouri except that the former carries the greater quantity of water.

The immediate effect of permanently diminishing the volume of flow in the river would be to impair its value for navigation. This effect would follow quickly—within a very few years. A later effect would be to diminish the capacity of the channel to hold the floods, and so raise the flood heights. How rapidly this shrinkage would take place can not be stated; but it would begin at once and go on until the relations of volume and channel capacity found an adjustment in which the natural bank level would approximate the mean annual flood height. This would mean overflow in all floods above the mean.

The *modus operandi* of the filling up process is simple enough. The flood leaves high, vertical banks on the concave sides of the bends. The enfeebled stream at low water cuts into those banks at the base. The undermined earth falls down in great masses into the pool. The weak current is unable to carry it away, and so climbs up over it and goes on gnawing at the base of the bank. By this process it grades down the bank and fills up the pool to greater or less extent. This operation goes on during every low water in the Mississippi River now. Vast quantities of earth are knocked down into the pools by the undermining of the concave banks. But when the flood follows it digs that material out again and piles it up on the convex sides of the bends. One of the striking sights to be seen on going down the river at low water after a great flood is the immense bars piled high up above the low-water line by the preceding flood. The present channel is the result of nature's adjustment between this filling-up process and this digging-out process. If the activity and energy of the digging-out process were diminished the channel would fill up until the adjustment had been restored.

If the present discharge down the main stream were reduced by one half at all stages, the energy of the excavating force would be reduced out of all proportion to the reduction of the effectiveness of the filling-up force. The low-water current would eat away the base of the high banks and fill up the pools with material which the diminished flood would be unable to remove. The result would be at last a readjustment of forces with shallower pools, lower concave banks, less filling up, less digging out, less everything that pertains to the life of a river. Then when the great flood came it would find a diminished channel to carry it and would overflow the country as before. There would be less water to take care of and it may be that the floods could be restrained by levees of less height. As against that gain, however, we would have another river to take care of with its low water and high water, its bars, floods, overflows, levees, crevasses and other burdens and calamities. All in all, our last state would be worse than our first.

As for navigation, the present large schemes for ten feet or more from Cairo down would all go glimmering. The superb advantages which nature gave us in the one great river would be thrown away in exchange for two smaller rivers, more expensive to control, more destructive and less useful.

I have been discussing the feasibility of general protection of the alluvial valley from overflow by outlets. I have endeavored to take a practical view of the question by assuming definite plans with outlets and auxiliary channels definitely located. It seems to me that it is only necessary to approach the question in this direct and practical way to make it apparent that the outlet theory is a dream impossible of realization.

It does not follow from this that there is no situation in which no outlet of any kind

can have any utility. On the contrary, I think that there is a form of outlet which might possibly be employed upon the lower part of the river with advantage in conditions which may arise hereafter. Such outlets would be confined to points in the west bank below Red River. They would consist of regulated spillways, or waste-weirs, taking off the top layer of extraordinary floods and conducting the water to the sea across the Atchafalaya basin. Their object would be to alleviate extreme flood heights through the sugar country and at the city of New Orleans. They would have no effect upon floods in the central and upper parts of the valley. They would not be outlets, as the word is usually applied, but waste-weirs in the strict sense of the word—long, shallow notches in the top of the levee, stone paved and side walled to prevent the possibility of enlargement, with secure channels leading to gulf level in the Atchafalaya lakes and bayous. Their construction would be experimental both as to benefits in relieving the strain of great floods and as to their effect on the channel below them. I speak of them now for the sake, more than anything else, of forestalling any suggestion of inconsistency on my part in case the developments of a few years to come should indicate a need of them. I do not want to be tied to a word. The outlet theory is a delusion. At the same time, a safety valve in the form of an outlet might have a certain utility in a certain situation. This would not be as a substitute for a levee system, but as an adjunct to a completed and perfected levee system.

The time has not come yet for the practical consideration of such a scheme. We do not know enough to enable us to form a reliable judgment of the probable necessity and utility of it. We must hold a flood or series of floods so effectually that we shall be surer than we can be now of the elevations to be expected. It may cost us some dear experience—some bad breaks and disastrous overflows, but for the present nothing should be allowed to divert our money or our attention from the main work in hand—the full completion of the grand levee system of the main river. I have spoken of the possible utility of spill-ways, or waste-weir outlets, below Red River in order to mark with exactness that limited application of the outlet method which I believe to be feasible, and possibly useful, as distinguished from its general application, which I believe to be utterly impracticable.

On the subject of reservoirs little need be said. It is a delightful scheme to think of and talk about. It would beautify the map with lakes throughout the upper valley. It would bring the delights of boating, fishing and swimming within the reach of millions of us to whom they are now inaccessible pleasures. It would remove all danger of a surplus in the national treasury for a long time to come, and it might reduce the surplus in the Mississippi River somewhat.

When men think of reservoirs in this connection they commonly locate them in the headwaters of the Mississippi and the Missouri. Unfortunately, it is not there that the rains fall that furnish the stuff for great floods, but in the valley of the Ohio and its tributaries. The storms that sweep from the southwest across the Ozark Mountains and on over Kentucky, Illinois, Indiana, Ohio, western Pennsylvania, West Virginia and Tennessee are the bearers of woe to the people of the alluvial valley. One of the consequences of those rains has been to make the regions where they fall so fertile and attractive that they are filled with population, farms, cities, railroads, factories and all the adjuncts of high civilization. To occupy the country with the reservoirs necessary to hold back a great Mississippi flood would involve an incal-

culable destruction of property, to say nothing of the cost to build them.

There is one place where it would be possible, in an imaginative sense, to impound a volume of water that would be missed from the river. That place is the St. Francis basin, 6,700 square miles in area. By cutting that area up into subdivisions by dams crossing it at frequent intervals, and increasing in height progressively down stream as rapidly as the slope of the land surface would permit a vast storage of water could be secured, many feet deep at its lower border. But the only material that can be found there to make the dams of is earth. The expense of stone would be scarcely thinkable. And to imprison such a volume of water at the head of such a valley as would lie below it with only earthen walls to hold it back would be nothing less than criminal foolhardiness. The best use we can make of the reservoir theory is to keep it to talk about.

We frequently hear the present large projects for the storage of water for purposes of irrigating arid lands in the west spoken of as though valuable aid in the control of the floods of the Mississippi could be obtained from those works. For want of more accurate knowledge of the possible extent of that storage and its locality I can say no more than that while it may help a little, it appears to me that it can be no more than very little. It must be remembered that it would be of no advantage to the Mississippi River to diminish its volume at ordinary stages, or even ordinary flood stages. It is only by the power of its vast discharge that its great channel has been produced or can be maintained. A permanent reduction of its ordinary annual floods would tend to diminish its channel capacity. Better a great channel with a maximum discharge of 2,000,000 cubic feet per second than a less channel with three quarters of that volume, so the water can be kept within the banks. If the irrigation reservoirs should operate, as I fancy they would, to store a substantially uniform quantity of water each year and distribute it over cultivated lands, to be for the most part evaporated or absorbed, they would serve no useful purpose to the Mississippi except in rare and extreme floods, when it may be said that the smallest reduction is of some value.

All this emphasizes more and more the main truth that the present levee system has been so thoroughly tested, and has been of such incalculable value, and is so near completion, that it is a sort of treason to turn aside to talk about anything else for any other purpose than to illustrate by contrast the transcendent importance of finishing up what we have in hand.

Even this phrase needs definition. In a sense the levees of the Mississippi never will be finished. But they can be extended, raised and strengthened until they will hold the water even in such floods as that of last spring. At that period they will be 'finished' in the only sense in which it will ever be possible to apply that word to them.

It is not necessary, either, to the achievement of 'success' that they shall never be broken by crevasses. I have said that during the flood of 1903 the existing levees protected from overflow seven eighths of all the lands capable of protection by them if not one had failed. Suppose we should never be able to do better than that. Suppose great floods should come once in five years, and we should always save seven eighths of the land from overflow. That would mean that, upon the whole, taking all the years and the whole valley into account, there would be an average annual inundation of two and a half acres out of every hundred. I should call that success.

ROBERT S. TAYLOR.

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MUSEUMS AS PLACES OF POPULAR CULTURE.

A CONFERENCE on this important subject took place at Mannheim, Germany, on September 21 and 22, having been convened by the Centralstelle für Arbeiter-Wohlfahrtseinrichtungen, an organization for social work that has its headquarters in Berlin. The meetings were held in the Aula of the city Realgymnasium, under the presidency of Dr. Schenkel, minister of the interior for Baden, and were attended by about two hundred people interested in this social question, of whom over fifty were practical museum officials, from all parts of Germany, with half a dozen from Switzerland, Austria and England. A philosophically ordered program had been drawn up some time beforehand, and was carried out with very slight modification. We take the following from a special report in the *Museums Journal*. The meeting on each day lasted from 9:30 A.M. till 4:30 P.M., with an hour's interval for lunch. Opportunities for social intercourse were abundant—at lunch, dinner and in the evenings; the museums and similar institutions of Mannheim and Heidelberg were thrown open to members, many of whom also visited the museums of Darmstadt, Mainz, Worms and other neighboring towns. Free seats were reserved for members at a special performance of 'The Merchant of Venice,' to which work-people were admitted for 40 pf.

The object of the conference was to discuss in what ways museums could bring themselves into touch with the working classes. The subject was introduced by Dr. Lichtwark, of Hamburg, who pointed out that modern museums differed from universities and academies in being open free to all classes; nevertheless, the very small proportion that the number of their visitors bore to that of the inhabitants showed that they needed to be made still more popular. Universal rules could not be laid down, but he foresaw a great revolution in the equipment and methods of museums, which would have to be brought into relation with men's daily life. The gradual change in the nature of museums was then traced by Dr. Jessen, of Berlin, who dealt with museums of fine and applied art, and by Dr. Lampert, of Stuttgart, who spoke of natural history museums. There followed what professed to be accounts of actual attempts made by various museums to render their treasures more useful to a wide public; but these tended to become simple descriptions of the museums. One gathered, however, that the Bremen city museum depended more on labels than on guide-books, that visits to it were obligatory on the school children, who afterwards were made to write essays on what they had seen, and that a reading-room and lecture-hall were connected with the museum. Dr. Lehmann explained how the exhibits of the Altona museum were devised so as to force their meaning on the dullest spectator, *e. g.*, two cases of the same assemblage of animals, one in summer, the other in winter; the popularity of the recently installed fishery exhibit showed how crowds could easily be interested in what really came home to them. A somewhat similar museum at Celle was described by Dr. Bomann. Professor Andreae advocated the use of photographs and their constant change, as at the Roemer Museum, Hildesheim; he thought that small museums should be many-sided. The description of the geological room at the Berlin museum, admirably arranged by Dr. Jaekel, showed that it was intended for students rather than the great public. Mr. Osthaus believed that a joy in art should and could be brought to the working classes, but the Folkwang Museum aimed at this by first influencing manufacturers and leaders of work through the exhibition

of the best art, and chiefly living modern art, in the most beautiful manner. Better to create art to-day than to be learned in the art of the past. Thus could art be pressed into the service of all. On behalf of Dr. A. B. Meyer, Dr. Wandollek described the efforts of the American museums in this direction, especially as regards children. The similar efforts of the school-museum at Hannover were detailed by Dr. Wehrhahn, who said that the small people found his simple rooms more attractive than the large museum palaces. An account of the Ruskin Museum in Sheffield had been distributed to members, and Mr. Gill Parker confined himself to showing a large series of lantern slides illustrating the activities of that institution. In the discussion on the above papers, Dr. Leisching, of Vienna, said that the Austrian government had established a circulating museum department, which sent art collections to towns that had no permanent museum, and arranged for lectures on these exhibitions by teachers at the high schools. Scepticism as to the value and possibility of the whole movement was manifest in the discursive speech of Dr. Lessing (Berlin), who maintained that the public as a whole, from the man in the street up to 'his Excellence'—and higher still, had not and could not be given a feeling for art, which term, however, seemed in the speaker's mind to signify chiefly ancient art and the old masters. A museum guide to art should be modeled on Huxley's 'Crayfish.' Dr. Pauli, of Bremen, was astonished to hear such retrograde views. No museum supposed that it could turn a road mender into a connoisseur on a Sunday morning, but it might be proud to have inspired only one or two per cent. of its visitors. The upper classes felt themselves above instruction, but working people were far more susceptible, and it was from them that future creative artists were to be expected.

The program of the second day, dealing as it did with limited questions of practical importance, gave rise to a more lively discussion. Dr. Lichtwark voiced those complaints about the architecture of museums with which we are familiar, objecting, among other things, to the corridor-like arrangement of rooms *en suite*, to the waste of space and money on a huge stair-hall, and especially to the domination of a whole museum by the architect's conception of his façade. As a small museum in which the architect and decorator had solved their special problem in a satisfactory manner, he instanced the Thorwaldsen Museum in Copenhagen. For appealing to the people of a large city, a number of small museums were better adapted than one large central museum. Dr. Jessen, emphasizing the point that museums should be built for the objects placed in them, maintained that the buildings should not be erected until a large amount of material had been collected, since not till then could one see precisely what was wanted. Professor Grosse, director of the art museum at Freiburg i. B. pointed out very clearly that one should not confuse the scientific study of art with the faculty of appreciating beautiful works of art, which latter was the need of the lay public. The collections for these two purposes should be separated. He, therefore, advocated the setting apart for the public of certain rooms, in which carefully selected objects should be displayed according to esthetic principles, abundance of space being allowed to each object, especially to the smaller ones. Different classes of objects should be intermingled, and the exhibits should be changed at intervals. Dr. Grosse was warmly applauded and his ideas were supported by several subsequent speakers, for instance, Dr. Schmid, of the Bavarian

National Museum, who also urged the value of small local museums for the encouragement of an art connected with the life of the people. Dr. Lehmann held that, so far as the public was concerned, the same principles were applicable to natural history museums. These ideas also found expression in a careful essay by Dr. Kautsch (Halle a. S.) on guides to, and lectures in, art-museums. The aim of these should be not to give a watered-down history of art, but to teach people to see; not to instil theories, but to evoke a conception of form; to create artists and artistic craftsmen, not to stifle the artistic faculty under the weight of learning that oppressed our so-called cultured classes. Professor Fraas, of Stuttgart, speaking of similar methods in natural history museums, gave the good advice that illustrations should be not pictures of specimens in the collection, but explanatory diagrams. His other remarks were much to the point, but the gist of them is familiar to our readers. In a detailed paper on temporary exhibitions in museums, Dr. Deneken, of Crefeld, inveighed against the superfluity of the usual class of exhibition, especially of art exhibitions, which had done the greatest harm to the development of art and were opposed to its true aims. Especially harmful were the permanent exhibitions of societies, with their commercial standpoint. For an exhibition to be useful, it should have a leading idea rigidly carried out; thus esthetic pleasure could carry with it artistic instruction. Even when the museum relied on its own resources there should be a selection of exhibited material on these lines and a constant change so as to keep up the public interest. This change would be helped by loan exhibitions, but here too the most careful selection must be enforced.

A speech from the minister of the interior and a vote of thanks to the town of Mannheim brought the proceedings to a close, and it only remains for us to mention an exhibition of various museum objects and methods that had been arranged, along with a collection of literature bearing on the subject.

In estimating the value of this congress, one must not look for immediate results in the rush of working folk to museums. Museums, as they now exist, are not suited to this new part they have to play. Fresh museums must be built, old ones adapted where possible, and, above all, new men to direct them must be trained. Any doubt as to the trend of events would have been dispelled by attendance at this congress; in such controversy as there was, the younger men were all on one side, and it is their views that are endorsed by the able critic of the *Kölnische Zeitung* (September 27). From a social point of view the outlook is encouraging, and the Berlin headquarters for the betterment of the workers may be congratulated. And as for museum men themselves, let us note that this is the first public conference of museum officials as such that has been held in Germany, probably on the continent. But, the first though it be, we find a remarkably large attendance, and including men of the highest official standing, while the whole is patronized by the government, presided over by a minister, and, last but not least, fully noticed in the press. Seeing how overdone with congresses they are in Germany, this bears witness to the skill with which the meeting was engineered. Whether it will give rise to further reunions, arranged by the museum officials themselves, remains to be seen; but this at least has been a gain, that it has brought together the mutually indifferent, not to say intolerant, science men and art men, and has shown them that they form allied branches of a great profession, working for one noble cause, and aiming at the same lofty mark.

SCIENTIFIC BOOKS.

Contributions to the Tertiary Fauna of Florida with especial reference to the Silex Beds of Tampa and the Pliocene of the Caloosahatchie River. By WILLIAM HEALEY DALL, A.M. Transactions of the Wagner Free Institute of Science of Philadelphia, Vol. III., pp. 1654, 60 plates.

With the appearance of part VI. the Wagner Institute has brought to a close the work upon the Tertiary geology and paleontology of Florida begun in 1886, and recorded in Vol. I., and the series of volumes composing 'Vol. III.' of the *Transactions*. Vol. I. (1887) by Professor Angelo Heilprin, announcing the discovery of the Caloosahatchie Pliocene beds by Professor Heilprin and Mr. Joseph Willcox, with a first report on its fossils and those of the silex beds at Tampa, has already been noticed in these columns.

In 1890 the work was resumed by Professor Dall with the cooperation of the U. S. Geological Survey, originally with the intention of exploiting the Tampa silex beds (then called Old Miocene), the Chesapeake Miocene and the Caloosahatchie Pliocene. As the work progressed, these bounds were found too narrow for the full development of the subject, and practically all marine Tertiary faunas of America, from Panama to Canada, have supplied materials for the work. Even Cretaceous horizons have been laid under contribution. This spreading of the subject over faunas not indicated in the title of the work has provoked some adverse criticism not wholly undeserved, for it is undeniably a hardship to have new Cretaceous species described in a work on Neocene paleontology. But to the evolutionist, the student of molluscan genealogies, this wide range of comparison in a vertical direction, so to speak, is of inestimable value, and in the hands of Dall has brought out the relations of successive faunas in a way never attained by the old method of dealing with each formation separately.

Although the work deals only secondarily with stratigraphy, yet the collateral researches and field explorations undertaken in connection with the paleontological work give it high value from the purely geological standpoint. It marks an epoch in the study of eastern and middle American Tertiary deposits. The recognition and exposition of the marine Oligocene of Florida and the Antilles is one of the notable advances in geological knowledge. In the earlier part of the work it was recognized that the so-called Miocene of Florida comprised two very dissimilar faunas, and to the earlier the term Old Miocene was applied in this work. Further study and material showed that this 'Old Miocene' had nothing to do with the Miocene of the United States in its most typical development, as in Virginia and Maryland, but represented a group of horizons strictly analogous to those which had received from European geologists the name of Oligocene. These horizons contained a very rich warm-water fauna which was soon found to be more or less distinctly represented in the Tertiaries of middle America and the West Indian Islands." This led to the examination of the fauna of the beds at Bowden, Jamaica, and in Santo Domingo, etc., that the correlation of Antillean and continental beds might be discovered. "It was found that the connection between the Atlantic and Pacific faunas ceased at about the climax of the Oligocene, and that the relations between the faunas were so intimate that the Pacific coast forms could not safely be entirely neglected." These conditions gradually led to an extension of the work, in the course of which 'several distinct Oligocene faunas have been worked out with fulness and their relations established; a wide extension has been given to the Pliocene deposits, long confused with those of the Upper Miocene; the geological relationships of the beds between the Vicksburgian and the Pleistocene have been established in their main lines more clearly than has hitherto been the case.'

Regarding Antillean geology, Dr. Dall considers that the views of Professor R. T. Hill are supported by the evidence of Mr. T. W. Vaughan's field observations, and the information from other sources, as opposed to the hypotheses of Dr. J. W. Spencer, based upon his studies of submarine topography and of non-fossiliferous terranes supposed by Spencer to be marine Pliocene and Pleistocene. This

conclusion is not unexpected by those who have carefully examined the evidence, both geological and faunal. The data of zoogeography are wholly at variance with Spencer's hypotheses involving oscillations of gigantic vertical amplitude within late Neocene time.

To the paleontology Dall has brought to bear the experience of a life-long study of recent mollusca, an advantage possessed by few, if any other, writers upon American fossils. This has led naturally to a juster appreciation of the morphologic problems encountered than has been possible to most paleontologic authors, whose acquaintance with living mollusks is, as a rule, largely at second hand—from the manuals rather than the things themselves. With the great collection of recent American marine mollusks in the National Museum, the material for exact comparison of the fossil and existing forms was always at hand, and a vast number of corrections and rectifications of all sorts, in the nomenclature and classification of both recent and Tertiary mollusks have been made. This gives the work fully as much value to the student of existing faunas as to the paleontologist.

During the progress of the work a new classification of the bivalve mollusks (Pelecypoda) has been elaborated, a separate part being devoted to an exposition of the general system of pelecypods. Whether or not this classification will eventually supersede that of Pelseneer, which at present is generally adopted abroad, it possesses certain manifest advantages for the paleontologist over that of the Belgian zoologist, in that the hard parts, which alone are preserved as fossils, are taken into account. The work of Newmayr, the researches of Bernard and others upon the ontogeny of the bivalve hinge, and the phylogenetic studies of Dall himself, all indicate that the several elements of the hinge with its interlocking processes or 'teeth' are the biological expression of stresses to which they are subjected in the individual. The evolution of these wonderfully adapted structures has been in part worked out, so that the great part played by parallel or convergent evolution, hitherto hardly taken into account by paleontological students of bivalves, is now exposed, and sound phylogenies become possible.

Those who oppose the major divisions of Dall's classification will admit that the marshalling of the families into superfamily groups, and the internal analyses of these groups, has been accomplished with the consummate skill of a master.

In many groups of bivalves the classification down to genera and subgenera is worked out for all known forms, so that the work is a general manual of the subject, often with an entire recasting of the groups and their definitions, as in the Mactracea and Leptonacea (Parts IV. and V.). The treatment of the Veneracea and allied groups in Part VI. is equally elaborate, though less completely revolutionizing prior conceptions.

The matter of nomenclature has received great attention, and as a general rule the numerous changes of current usage have been made with excellent judgment. In some cases, such as that of *Pisidium*, it would seem that Dall has gone more than half way to meet trouble; while the emendation of some other names for the sake of Latin form will not be received with general enthusiasm. Thus if *Pitar* Römer (1857) is barred from acceptance because of its derivation from a West African tongue, it can not be used as a generic name in the form *Pitaria* (Römer) Dall (1902), because several other names were applied to members of the genus between these two dates, one of which would lead as a generic term. Here, as usual in such cases, it seems best to accept a generic name as it was coined, even if it is bad Latin. Little advantage or glory comes from breaking lances against such windmills.

An interesting and valuable point to the evolutionist is the persistence through long periods of characters apparently trivial—now a minute lamella or tubercle in the hinge, now an external sculpture-pattern or an internal sculpture, like the marginal grooving of *Transennella*. What we have looked upon as mere 'ornamentation' has often suffered the least change from age to age, and characterizes the successive members of phyla which in structures apparently far more important have

gone on evolving in parallel or divergent series. H. A. PILSBRY.

SCIENTIFIC JOURNALS AND ARTICLES.

The American Naturalist for January contains the fourth of the series of papers on 'Adaptations to Aquatic, Arboreal, Fossorial and Cursorial Habits in Mammals,' the present being devoted to 'Cursorial Adaptations,' by Richard S. Lull. R. W. Shufeldt has a lengthy paper 'On the Osteology and Systematic Position of the Pygopodes,' giving at the end a comparison of the differential characters of the loons and grebes which are considered as forming two superfamilies. The affinities of these groups to the extinct *Hesperornis* are said to be practically certain, but this conclusion should be received with caution. T. A. Jaggar, Jr., renders a translation of the account of 'The Eruption of Mount Pelée, 1851,' from the French of Le Prieur, Peyraud and Rufz which is of considerable interest. The balance of the number is devoted to reviews and notes.

The Popular Science Monthly for April begins with an account of 'Recent Discoveries in Radiation and their Significance,' by R. A. Millikan, briefly summarizing our present knowledge of the subject and suggesting that certain elements, at least, are transmutable into others. 'The Evolution of the Human Form' is discussed by Charles Morris, who reaches the conclusion (somewhat open to question) that if there are beings on the other planets that answer to man they must follow his physical configuration. Solon I. Bailey describes 'The Arequipa Station of the Harvard Observatory' and Edward F. Williams presents his second paper on 'The Royal Prussian Academy of Science and the Fine Arts, Berlin.' Carl Duisberg considers 'The Influence of Liebig on the Development of Chemical Industries,' believing that while this is now great his indirect influence will be still greater in the future. J. Madison Taylor has the third article on 'The Conservation of Energy in Those of Advancing Years,' a general plea being for rational exercise and diet and not dependence on drugs. 'The Caucasian in Brazil' is considered by Thomas C. Dawson, who believes that he can hold his own in the tropics and adduces figures to show the greater fertility of the white race. Finally, Guy L. Hunner treats of 'The Air of the Luray Caverns.' The number contains the index to Vol. LXIV.

THE April number of the *Transactions of the American Mathematical Society* contains the following papers:

G. A. BLISS: 'An Existence Theorem for a Differential Equation of the Second Order, with an Application to the Calculus of Variations.'

L. E. DICKSON: 'Determination of all the Subgroups of the Known Simple Group of order 25920.'

C. N. HASKINS: 'On the Invariants of Quadratic Differential Forms, II.'

E. D. ROE, JR.: 'On the Coefficients in the Product of an Alternant and a Symmetric Function.'

F. N. COLE: 'The Groups of Order p^3q^β.'

MAX MASON: 'Green's Theorem and Green's Functions for Certain Systems of Differential Equations.'

E. J. WILCZYNSKI: 'Studies in the General Theory of Ruled Surfaces.'

SOCIETIES AND ACADEMIES.

THE BIOLOGICAL SOCIETY OF WASHINGTON.

THE 384th regular meeting of the society was held Saturday evening, March 19, 1904. Dr. C. E. Waters exhibited numerous specimens of common ferns in which the fronds were only partially fertile. The entire series demonstrated a complete gradation from the sterile to the fertile fronds. Dr. B. W. Evermann exhibited a series of seventy-three engravers' proofs of colored plates of Hawaiian fishes. All were drawn and colored from living fish, chiefly by A. H. Baldwin and C. B. Hudson. The live specimens were placed in an aquarium as soon as caught and the artist began work on them immediately or within a very short time. The result is an accurate reproduction of the actual life colors of the animals. The plates will be published in the near future by the U. S. Fish Commission.

Mr. W. P. Hay read a paper on the 'Life History and Economic Importance of the Blue Crab, *Callinectes sapidus*,' illustrating his remarks with lantern slide views. The more important life functions and habits of

the animal were described at some length. The process of casting the shell was detailed and several of the stages shown by photographs. Attention was called to the fact that the two forms of the female which have been described in this species are two conditions of the same individuals. One, with the narrow abdomen, is the original condition of the female, while the other, the form with the broad abdomen, is the condition assumed after union with a male preparatory to egg laying. It appears that eggs are not produced in water much less strongly salt than that of the open ocean. Consequently, egg-bearing females are seldom found in such bodies of water as Chesapeake and Delaware Bays, although crabs may be found in copulation there throughout the summer. The females probably die soon after spawning.

Under the title 'Natural Selection in Kinetic Evolution' O. F. Cook maintained that natural selection has a definite evolutionary function, not to be disregarded as under the theory of evolution by mutation. Selection is not, however, the direct cause of evolution; it is able to produce adaptations or accentuate particular characters by deflecting the normal evolutionary motion of species, which proceeds whether selection is operative or not. Selection represents, as it were, an obstruction in the evolutionary highway; the species is able to turn aside because it is normally in motion, not because the environment is able to initiate evolutionary changes in stationary organisms.*

Wilfred H. Osgood,
Secretary.

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

The 357th meeting was held March 8, 1904.

An interesting letter from Mr. C. H. Robinson, of Philadelphia, on certain ruins in Arizona, was read. Professor A. E. Jenks, of the Philippine Government, reports that he has secured living groups of the four principal peoples of the islands for exhibition at St. Louis. A letter from Dr. Daniel Folkmar detailing anthropological investigations carried on by him in the Philippines was read. Dr. Ales Hrdlicka announced the finding of cremated bones from Rockingham County and Scott County, Virginia, in the collection turned over from the Army Medical Museum to the National Museum.

The bill prepared by a committee of the society for the preservation of ancient ruins, and a resolution endorsing the same, were read. After a discussion by Dr. H. M. Baum and Mr. McGuire, the resolution was favorably acted on.

The general secretary exhibited a number of fire syringes from Burma, Siam and the Malay Archipelago, and demonstrated the efficiency of the apparatus for producing a spark. The range of the fire syringe was discussed, and it was suggested that the invention may have originated from the use of the popgun, or other air-compressing device. The paper was discussed by Mr. Safford and Dr. Hrdlicka.

Mr. W. E. Safford read a paper entitled 'Notes on the Language of the Aborigines of Guam.' The Chamorro-Spanish book on the Christian doctrine, written by an Augustinian friar, formed the basis of Mr. Safford's studies. The primitive words are of Malay origin, and not one per cent. are Philippine. The Guam language has affinities with the Papuan, as shown by the suffixed possessive particles. Mr. Safford discussed the spread of numerals, and says that complete data on this subject will go far to solve the problem of the origin of the Malayo-Polynesian and Papuan language. He called attention to the fact that the same system of numeration is spread from Formosa and the Malay Archipelago to Madagascar, and across the Pacific to Hawaii, New Zealand and Easter Island. A series of papers by Mr. Safford, embracing the grammar of the Guam vernacular, is appearing in the *American Anthropologist*. The paper was discussed by Dr. Lamb, Dr. Baum, Mr. Hallock and the secretary.

Mr. J. N. B. Hewitt read a paper entitled 'The Clan Among the North American Indians.' Mr. Hewitt said that among the Iroquois and most other tribes descent is on the female line. The clan is formed from

* For full discussion see *The Popular Science Monthly*, LXIV., pp. 445–456, March, 1904.

the coalescence of 'brood families or oachiras.' He detailed the rights and privileges of the oachiras and those of the clan which are more extended. Clan names are of some attribute of an animal rather than the name of the animal. In this connection Mr. Hewitt said that game animals were believed to be in duty bound to sustain man. The phratry was described as made up of several clans forming a unit for the celebration of festivals and ceremonies. The names of the Seneca clans with their meanings were given. The Iroquois League was organized like the clans by the rank or age of each unit giving a right to a certain place around the council fire. A very interesting branch of Mr. Hewitt's subject was the description of the method of transaction of business in council, when the matter under discussion was 'thrown across the fire' from side to side by the representatives of the different tribes. This valuable paper will appear in a forthcoming number of the *American Anthropologist*.

WALTER HOUGH,
General Secretary.

THE NEW YORK ACADEMY OF SCIENCES.

SECTION OF GEOLOGY AND MINERALOGY.

A REGULAR meeting of the section was held at the American Museum of Natural History, Monday evening, March 21, with the vice-president, Professor James F. Kemp, in the chair. Two papers were upon the program for reading. The first of these was by Mr. H. H. Wotherspoon, Jr., upon 'The Recent Advances in the Utilization of Peat and Lignite.'

The author said in part that the question as to the derivation of the fuel supply of the world is becoming more and more important. For years Europeans have been striving to devise a fuel to take the place of wood and coal. Recent advances in the price of coal in the United States have directed attention in this country along the same lines. In Europe, and particularly in Germany, many factories have been established for the compression of lignite, or brown coal, and peat into briquettes.

The principal deposits of lignite are near Berlin and Cologne. The larger of these is south and east of Berlin and is known as the Lausitz district. About 280 factories for the manufacture of briquetted fuel, with a total of 680 presses, have been established in these two regions, and their output in 1902 was approximately 12,438,000 metric tons. The briquettes are about 7 inches long, 2½ inches wide and 1½ inches thick, with rounded corners. Their wholesale price in the larger German cities is between $2.10 and $2.25 per metric ton.

Excellent briquettes have been made from the lignite of Alabama, but the experiments with the lignites of North Dakota have been less successful. The calorific value of the German briquettes is from 7,500 to 9,000 B.T.U.'s. True peat and other bog matter is becoming of importance in the manufacture of briquetted fuel. The process of manufacture which has been employed in Canada has depended upon heat for the expulsion of the major part of the contained moisture. This has been an unsatisfactory method, because the temperature (280° F.) necessarily employed has weakened the natural cementing qualities of the bog material.

The German method which has been very successful is to break up rapidly and thoroughly the cellular structure of the partly decomposed vegetable matter. This sets free the water from the plant fiber without injuring the cementing material. In the process part of the moisture is squeezed out of the mass, and the remainder evaporates rapidly on exposure to the air. The briquettes are ready to use in about two weeks after leaving the machine. Their calorific value is greater than that of the briquettes made from lignite.

The briquettes made from American bog matter seem to be as good as the European. The percentage of ash is high, but the ash is very free in character. This characteristic, together with the absence of sulphur, makes the fuel work well under boilers. Wherever transportation charges bring the cost of coal up to seven or eight dollars a ton, it is advisable for Americans to investigate the matter of utilizing neighboring bogs as a source of fuel supply.

Mr. Wotherspoon's paper was illustrated by a series of briquettes manufactured from European and American lignites and peats. He also exhibited a machine by means of which he manufactured in the presence of the section briquettes from peat which originated in Danbury, Conn. The paper was actively discussed, and many questions bearing upon the economic features brought forward by the author were asked.

The second paper of the evening was by Dr. Charles P. Berkey, of Columbia University, and was entitled 'A Geological Reconnoissance of the Uintah Reservation, southeastern Utah.' The author said in abstract:

Observations made in connection with other lines of work last summer have shown an erosion unconformity in the Carboniferous strata of the western Uintahs. It is marked on the south side of the range by an unevenness in the floor and a development of a conglomerate the pebbles of which are of the preceding formation. The break comes just above the chief limestone member of the series.

The junction between the great basal quartzite of the United States and the overlying strata is marked by a fault in this region with sufficient throw to bring two quartzite beds together on the higher plateaus and be easily overlooked. This makes it impossible to confirm Powell's unconformity at the top of the quartzite as described by him in the eastern Uintahs.

The discovery, however, of the Carboniferous erosion interval a little higher in the series throws additional doubt upon the assumed Carboniferous age of the great quartzite member. Allowing the breaking to cut out a part of the 'Wasatch' limestone and the 'Weber' quartzite, as developed in the Wasatch uplift, the lithologic succession is satisfied better by assuming Cambrian age for the lowest member in the Uintahs.

There is no other break to the close of the Cretaceous. A progressive unconformity, which increases in value against the flanks of the range, marks the development of Tertiary sediments in the Duchesne Valley. A conglomerate formed in progressive overlap from the stream valleys to the higher mountain tops of the flanks, has peculiar characters near the limestone belt, on account of which King called it 'Wyoming' conglomerate. These characters are too local to give it the assumed stratigraphic importance, while the flanking conglomerates are really of great range.

Edmund Otis Hovey,
Secretary.

THE AMERICAN CHEMICAL SOCIETY.
NEW YORK SECTION.

At the meeting held March 11 at the Chemists' Club, 108 West 55th Street, the program was as follows:

Derivatives of Ortho-Methoxy-Benzylidene Acetophenone: F. J. Pond and J. V. R. Evans.

The authors describe the preparation of o-methoxy-benzylidene acetophenone and of its di- and tri-bromides. The action of methyl and ethyl alcohols and of sodium alcoholate upon the two bromides is compared with the action of the same reagents upon the bromine derivatives of p-methoxy-benzylidene acetophenone. In the latter case, the alcoholate removes one atom of bromine with substitution of the methoxy- or ethoxy- group, while with the bromides of the ortho- derivatives no such change is noted; this marked difference in the reaction of the two classes of compounds is ascribed to the influence of the position of the phenolic ether group in the para- and ortho-compounds.

The action of sodium alcoholate converts the dibromide into alpha-oxy-o-methoxy-benzylidene acetophenone, while the same treatment of the tribromide gives rise to two isomeric substances, alpha-oxy-o-methoxy-brom-benzylidene acetophenone and o-methoxy-brom-benzoyl benzoyl methane (a 1, 3-diketone), Various derivatives of each compound are described.

Nitrosulphuric Acid and Its Action on Organic Compounds; Part II.: C. W. Volney.

Dr. Volney presented the results of experimental work on hydrolysis of nitric acid by sulphuric acid and formation of nitric anhydride, the existence of combinations between the anhydrides of sulphuric and nitric acids

having been shown in Part I. of this paper (read November, 1903).

The effect of mixtures of nitric and sulphuric acids on organic compounds was then discussed and compared with the reactions obtained by the use of mixtures of nitric acid and anhydrous phosphoric acid under similar conditions. The conclusion reached was that nitrosulphuric acid or the 'mixed acids' of commerce are not merely mixtures, but contain the product of hydrolytic reactions of sulphuric acid in excess on nitric acid, thus explaining their reaction on organic compounds and production of nitro-substitutions, especially of nitro-cellulose.

The Chemistry of Rubber Colors: M. TOCH.

Mr. Toch pointed out that many of the ordinary pigments are not applicable to the coloring of rubber goods, either because the color would be changed by the heating and the reagents used in vulcanizing and finishing rubber, or because of some objectionable effect of the pigment upon the rubber mass. Oleic acid, used as a vehicle for aniline colors, is very deleterious. Stearic acid may be used for the same purpose and is less objectionable.

The following were mentioned as being among the most important of the mineral pigments used: Zinc oxide, zinc sulphide, barium sulphate, vermilion (less used than formerly), iron oxide pigments prepared from the sulphate, antimony sulphide, zinc chromate, 'chrome green,' sesquioxide of chromium and ultramarine.

Notes on the Analysis of Type Metal: E. H. MILLER and M. A. LAMME.

Dr. Miller referred briefly to some of the difficulties experienced in the analysis of type metal alloys, which are explained by the failure to obtain the tin completely in the stannic condition, and recommended that Clarke's separation be followed by the electrolytic deposition of tin as given by Herz, *Ztschr. für Anorganische Chemie,* 37, 1 (1903).

H. C. SHERMAN,
Secretary.

NORTHEASTERN SECTION.

THE fifty-first regular meeting of the section was held Wednesday evening, March 16, in Huntington Hall, Massachusetts Institute of Technology, Boston, with President W. H. Walker in the chair. About 1,000 members and invited guests were present.

Professor E. Rutherford, of McGill University, Montreal, gave an address on 'Radioactivity,' in which he reviewed the history of the discovery of the property of certain forms of matter of giving off radiations, and described the properties of such radiations, as Röntgen rays, X-rays, the alpha, beta, and gamma rays of radium, etc.

The theory of the continuous breaking down of the molecule of a high to one of a low molecular weight was adduced to explain the phenomena of the emanations and the enormous amount of energy manifested. The subject was thoroughly illustrated by experiments, among which was the transference of the condensed emanation of radium from one tube to another cooled with liquid air.

ARTHUR M. COMEY,
Secretary.

THE ONONDAGO ACADEMY OF SCIENCES.

THE February meeting of the academy was held on the nineteenth, at the College of Medicine, Syracuse University.

Mr. I. U. Doust and Mr. W. H. McClelland were elected to membership.

Dr. E. H. Kraus, as a reelected president, delivered an inaugural address, of which the following is an abstract:

Some Interesting Mineral Occurrences in the Salina Epoch: E. H. KRAUS.

Crystals which proved to be hematite were discovered in sewer excavations in the city of Syracuse during the spring of 1903, and in the summer of the same year celestite was found in the vicinity of Jamesville; the latter mineral up to that time had not been known to occur in that locality.

The crystals of hematite usually occur in the cracks and crevices of the red shale and are from one sixteenth inch to one half inch in length. They occur in scales and plates in which the basal pinacoid is much larger than any of the other faces of the crystal. The hematite, as usual, occurs associated with small quartz crystals.

The mineral celestite does not occur in veins or cavities, but disseminated through the rock, the manner of dissemination differing somewhat in different sections; in some places the crystals were not nearly so perfect as in others, often collected in small circular spots. The crystals have the usual combinations of faces found in celestite as well as the specific gravity and optical properties of this mineral.

While the mineral was originally found near Jamesville it has more recently been found elsewhere and, the author believes, is of general occurrence in the limestones of the Salina. In places where rocks containing the celestite were exposed to the weather, the mineral was dissolved, leaving cavities which by their distinct outlines indicate the character of the material which they had contained. In some localities the crystals were large and their impressions simulate the marks of chisel blades of about three fourths of an inch in width, occasionally single but often crossing one another.

In the rocks where this mineral occurs in circular particles, leaching gives rise to an appearance as if the stone were worm-eaten, and bearing a striking resemblance to the 'vermicular limestone.' The 'vermicular limestones' have given geologists much trouble as to a satisfactory explanation of their formation. That sodium chloride was the original occupant of these cavities seems doubtful. But celestite is soluble in water containing small quantities of sodium, calcium or magnesium-chloride. Analyses of the brines from the different salt-producing sections of the state easily proves the presence of these chlorides. With these facts in mind and knowing that the dissemination of celestite through the rock is not unlike that which would be necessary to form cavities as found in the vermicular and that when such a rock has been leached, the appearance of the resulting rock is like that of the vermicular, the conclusion seems unavoidable that these many cavities now empty in the vermicular must have once contained a mineral of the character of celestite and that by the action of the agencies mentioned above the same was dissolved, leaving nothing but the so-called cells to show its former presence.

J. E. Kirkwood,
Corresponding Secretary.

THE SCIENCE CLUB OF THE UNIVERSITY OF WISCONSIN.

The fifth meeting of the club for 1903–4 was held February 23, in the physical lecture room of Science Hall. The club had for its guest the local section of the American Electrochemical Society, this being the first meeting of the local section. The papers were presented by members of the section. The first paper, by C. F. Burgess, on 'Electrolytic Iron,' was illustrated by specimens and products of pure iron recently obtained by him by electrolysis. One specimen of extremely pure material weighted twenty-one pounds.

The second paper, by Oliver W. Brown, on 'The Electric Furnace,' was a general description of the recent advances made in electric furnace work.

The third paper, by V. Lenher, on the 'Solubility of Gold,' was illustrated by experiments and dealt with some recent work of the author.

Victor Lenher,
Secretary.

DISCUSSION AND CORRESPONDENCE.

CONVOCATION WEEK.

To the Editor of Science: Having attended a majority of the meetings of the American Association for the Advancement of Science during the past fifteen years I may, perhaps, be considered competent to contribute some impressions in regard to recent tendencies and the future development of the association which they apparently indicate.

It has always seemed to me that in any attempt to solve a problem such as that of the future policy of the association the proper course to pursue is to study the causes which have led up to existing conditions and from these to try and anticipate what the inevitable outcome is to be. Discussion of personal likes or dislikes is profitless if these are manifestly at variance with the general course of

development and whatever I may have to say will be predicated upon that principle.

The one tendency which has been so steadily persistent and so prominent in the development of the association as to overshadow everything else is that of specialization of work, and this factor is unquestionably destined to become more and more prominent from year to year. It was first manifested in the division of the association into its original sections, next in the subdivision of these, then in the organization of special societies distinct from the sections and finally in the further subdivision of the societies and the formation of new ones in accordance with the development of new lines of thought and investigation. This is a condition with which we must reckon and our effort should be to study how it can best be made to serve the objects and interests of the association. Another tendency, of more recent origin, the underlying motive of which I confess I have not been able quite to understand, is the tendency to separate on geographic lines. This is more or less an uncertain quantity and, therefore, its importance may be underestimated, but it is a factor which has to be taken into consideration.

Assuming that this course of reasoning is valid it would seem as if the association should make every possible effort to encourage the formation of new sections whenever the necessity arises and to make the scope of its influence as broad as possible. Many earnest workers in educational and economic subjects find no place open to them in any of the sections and hence the formation of many independent societies entirely out of touch with the association. Many of them meet at other times and places and both time and energy are wasted. On the other hand, the affiliated societies, which have sprung naturally from the influence of the sections, are a source of strength to the association and this could be further augmented by intelligent cooperation.

Much has been accomplished in this direction already, but it has not been systematically pursued. I have elsewhere proposed, and I take advantage of this opportunity again to urge, that an effort should be made to call a meeting of delegates from all societies which could properly be affiliated with the association in order that some uniform basis of cooperation might be secured.

The main province of the association in the future would seem to be that of organization and popularization of science. Let the summer meetings be continued, with the understanding that they are for the purpose of arousing and maintaining popular interest and to serve as a common meeting ground for professional and non-professional scientists, where the social element is to be encouraged and where beginners and amateurs may become acquainted with those whose names and works are known to them, but with whom they have never had the opportunity to become personally acquainted. I know of many instances in which embryo scientists obtained their first inspirations and their first insight into the possibilities which lay before them, through the medium of these meetings.

It may, perhaps, be an open question whether winter meetings in addition are advisable. The tendency seems to be to make these more technical and, perhaps, it might be wiser to encourage this idea. In other words, that at these meetings the affiliated societies should assume the leading position.

It ought to be feasible so to arrange the programs that at the summer meetings the societies could meet with the sections and have the association assume the greater prominence, while at the winter meetings the association could act more as a medium for bringing the societies together at one time and place.

Personally I do not believe in the advisability of meeting in regional sections. The less separation we have on geographic lines the better, although if this tendency is obvious I realize that it would be folly to oppose it. Before expressing any further opinion on this point, however, I should prefer to hear something more definite than has yet been brought forward by those who favor it, not only in regard to reasons for the proposed change, but also, approximately, the details of the arrangements which could be made for such meetings.

It should also be borne in mind that the

members are discussing the policy of the association more or less in the dark, as to the manner in which any changes would or might affect the finances and administration of the association. It would seem as if the discussion ought to include some words from the standpoint of the administration in order that all sides may have a hearing.

Arthur Hollick.
New York Botanical Garden.

The American Association for the Advancement of Science accomplishes a great work in making it possible for large numbers of scientific men to come together from year to year, and in this way alone does much for the promotion of science. The association can well afford to make generous concessions to affiliated and other scientific societies, even though they do not contribute directly to the financial support of the larger organization. We can not help feeling that these other societies are important to the welfare of the general association, and we are decidedly in favor, if possible, of making conditions such that the various societies will see material advantages in affiliating or coming into even closer relations with the older organization, and it would, therefore, seem to us wise to give the affiliated societies a larger representation in the council. We are not afraid of their exercising too much power in that body. They have come into existence to supply a need. Specialists have increased so rapidly that the original sections are not adequate for present conditions. We do not believe that special papers should be read before the sections, but they should either be referred to subsections or special societies.

It is much easier to suggest than to carry out, yet the last two meetings have emphasized the advisability of a more general classification of meetings and papers than has heretofore obtained. This is possible only through the cooperation of all societies meeting at the same time, and one of the great gains from a closer connection between affiliated and other societies and the association, would be the possibility of harmonizing programs. The many branches of science and the multiplicity of interests, renders this extremely difficult, still there are ways in which the matter could be simplified. It seems to us that two general sessions ought to meet every demand; one to mark the opening of the meetings and to permit of addresses of welcome, etc., and another in the evening to give the president an opportunity to deliver his address. The other general sessions amount to little more than a formal confirmation of the action of the council, and it would seem that this body might well be intrusted with all the governing powers, including the election of officers, since its members are elected at various times by the different sections and affiliated societies. Notices for each day could appear upon the program and thus do away with any excuse for a short daily general session every morning. This would allow unbroken forenoons for general meetings, and it would seem as though all the papers in related sciences could be classified. The general and special should receive equal consideration, and we would suggest that morning meetings be devoted to general papers, and afternoon sessions to special papers, which latter should be read before subsections or special societies. Some papers are of general interest to more than one group, and these would naturally have precedence in the morning and could be delivered before a joint session of one or more sections. Some arrangement of special meetings would be necessary for afternoons, so as to avoid conflicts likely to be produced by related subsections or societies holding sessions at the same time. Evenings not already occupied, as stated above, might be devoted to sessions for members of the association, at which two short addresses on topics of general interest could be delivered. Two such meetings might easily be held in different halls, and with proper grouping of subjects, there would be comparatively few who would wish to attend both. In addition to these short, general sessions, which should last an hour or a little over, we would favor continuing the popular complimentary lectures to the people of the city where the meetings are held and for such members of the association as cared to attend. These latter would be longer and more

formal than the short addresses mentioned above. All of these evening meetings could easily finish by 9:30, and give an opportunity thereafter for banquets and social gatherings, which have been a characteristic feature of previous meetings.

We believe that a classified system, such as described above, and including not only the regular papers presented before the American Association but also those before special societies, would do much for the advancement of science in America. The attending scientists would have, in the morning, a series of general scientific papers of interest to most of them, while meetings of subsections or special societies occurring in the afternoon would give an opportunity for the consideration of technical questions. The semi-popular short addresses in the evening would appeal to many of our members, while the more formal public lectures by prominent men would be an important stimulus and result in materially advancing science in America.

E. P. FELT.

THE WRITINGS OF WILLIAM J. LONG.*

THE last quarter of a century has seen a remarkable development of that form of literature which consists of charming popular writings about animals and their doings. A leader in this movement was John Burroughs, whose work combines literary grace with scientific truth to a degree not surpassed by that of any other modern nature writer, and there are several others in this country writing in the same spirit. Recently, however, there have arisen somewhat suddenly into prominence three writers on nature subjects whose works enjoy a popularity far surpassing that gained by any of their predecessors or contemporaries. These three are Mr. Thompson Seton (earlier known as Seton Thompson), Mr. W. J. Long and Mr. C. G. D. Roberts. Of the former I know little, but the two latter have written extensively of New Brunswick animals, and hence I have been much interested in their works, upon which I propose to make some comments from the point of view of New Brunswick natural history.

In examining the works of these two graceful writers, two queries naturally arise: First, as to the cause of their surpassing popularity, and second, as to their real scientific worth. The cause of their popularity is easily found. It does not lie in their literary charm primarily, for in this they do not so far surpass other nature books, but it consists in this, that they tell about animals, not as they are, but as people like to think they are. It is the humanization and idealization of animals, which, under the influence of the remarkable literary skill of these authors, has made their animal stories so popular. To accomplish this end, they have had to cut loose from the trammels of fact which hampered their predecessors, and have given their imaginations full play, thus producing fascinating works of fiction disguised as natural history. It is, however, this disguise which constitutes the chief ground of criticism against these works. We all agree that the use of animals as the heroes of romances is perfectly legitimate, but if such works pretend also to be accurate natural history, they unfairly deceive their readers and dishonestly claim a position to which they have no real title. It happens unfortunately that the works of both Mr. Long and Mr. Roberts are widely accepted as accurate in their natural history by the great majority of readers. Mr. Long positively claims that all he writes is accurate fact based on his personal observation, while Mr. Roberts allows an extensive personal knowledge of animals to be inferred, and takes no steps to correct this popular error.

Mr. Long has published five books on animals, containing many references to New Brunswick. The most characteristic feature of these books, especially of the later, is the marvelous character and remarkable number of the experiences the author claims to have had in his observations of animals. The aggregate of Mr. Long's reported observations, both as to quantity and character, is such that if all he reports is true, he has seen more widely and deeply into animal life than all other students of animal habits taken to-

* Read before the Natural History Society of New Brunswick (Canada), March 1, 1904.

gether. This I am not prepared to believe, especially in the light of the tone of his own writings, which seem to me to show that he possesses neither the temperament nor the training essential to a disinterested observer. I have no proof, with the single exception noted below, that any individual statement of Mr. Long's is untrue; but an experience in the New Brunswick wilderness at least as great as Mr. Long's has given me such a knowledge of the difficulties of observing wild animals in their native haunts that I can not believe that any man has had all of the remarkable experiences reported by Mr. Long. Furthermore, the one case in which I happen to know personally the evidence on which Mr. Long bases a statement does not allow me to entertain a high regard for his accuracy. In his book 'School of the Woods' he claims to have seen fish hawks catch and wound fish which they then dropped back into the water in order to teach their young to dive for them. This statement is criticized by Mr. Burroughs in his article on 'Real and Sham Natural History' in the *Atlantic Monthly* for March, 1903, and in his reply to this article in the *North American Review* for May, Mr. Long reaffirms it, and adds: 'Mr. Mauran Furbish, who probably knows more of the New Brunswick wilderness than any other man, has told me since my book was written that he had seen the same thing.' Thinking I knew the incident on which this statement was based, I wrote Mr. Furbish, who has been my companion in two journeys into the wilderness of New Brunswick, asking what statement he had made to Mr. Long. He replied that he had simply told Mr. Long of our finding one day a wounded gaspereau floating at the foot of a lake and that Mr. Long 'had furnished all the romance and the reason for their being there.' This incident, I believe, gives the clue to the character of much of Mr. Long's work. He does not deliberately invent, but some trifling basis of fact happening to fit in with some theory developed by his sympathies is accepted by him as confirming his surmises, which he thereupon considers and publishes as proven. Mr. Long's books undoubtedly contain a great deal of valuable fact, but this is so mixed with matter that can not possibly be accepted simply on Mr. Long's statement, that it makes his works practically valueless for any scientific purpose.

Mr. Roberts, I believe, nowhere makes any claim that the natural history basis for his animal writings rests on personal knowledge, but that is the impression left with the reader, and Mr. Roberts takes no steps to set him right. Those who know Mr. Roberts are aware that his literary work for several years past has not permitted him to make those journeys into wild New Brunswick essential to the study of its animal life, and that his few earlier trips had not this object in view and were not of a character to permit it. His knowledge of New Brunswick animals has been gained chiefly in the public libraries, museums and menageries of New York City; his material is hence mostly second hand, and it is unfair to his readers that they should be given the impression that these works are founded on a personal knowledge of the animals described. If Mr. Roberts would but state in the preface to his books that his studies are not based upon personal observation of their subjects, but are as accurate as he can make them from other sources of information, he would not only be dealing honestly with his readers but he would, in my opinion, greatly enhance the value of his really remarkable imaginative works.

So opposite are the standpoints from which the scientific and the literary man view animal life, and so entirely indifferent are they to one another's standards, that the two are not only nearly impossible to one person, but they are well nigh mutually exclusive. The charm of the study to the man of science is the triumph of demonstrating the truth. He makes this his sole standard as it is his sole reward. Slowly, patiently, laboriously, indifferent to popular opinion as to popular applause, he makes his resistless advances, testing and proving each step before a second is made. He naturally has little regard, therefore, for showy leaps from scanty fact to sensational generalization, and he has no respect at all for a pretence of scientific knowledge not based upon an honest foundation. The lit-

erary man, especially the new nature writer, seems to view nature chiefly in the light of a fresh supply of literary material, and he values her phenomena in proportion to their adaptability for interesting and clever treatment. To him the truth is not of first importance, and imagination is allowed to improve upon nature whenever she can thereby be made more available for literary uses. All this may be legitimate in literature, but works thus inspired should not expect to be accepted also as science, nor should they pretend to an authority they do not possess.

SMITH COLLEGE. W. F. GANONG.

IF the article entitled 'Woodcock Surgery' (SCIENCE, February 26) were nothing worse than a frisky, good-natured breeze every one would doubtless be willing to let it pass without notice, but its temper and twists are such as to require a word that may possibly 'seem unkind.' Its author says that Mr. Long "virtually claims that a woodcock not only has an understanding of the theory of casts as adapted to fractured limbs, but is able to apply this knowledge in practise. The bird is represented as knowing the qualities of clay and mud, their lack of cohesion unless mixed with fibrous substances, their tendency to harden on exposure to the air, and to disintegrate in water." "His woodcock is familiar with the theories of bone formation and regeneration—in a word, with osteogenesis." "He divines the functions of the periosteum," etc. Instead of claiming anything of the kind, Mr. Long tells us in simple language what he has seen, offering neither inferences nor generalizations. It is his critic, Mr. Wheeler, who 'virtually' affirms that a woodcock could not apply mud to a broken leg without a knowledge of surgery; and it is much as if he should say that a man who blows on his fingers to warm them or on his tea to cool it has a knowledge of the laws of thermodynamics and is ready to discuss entropy or an indicator diagram. It is the merest commonplace fact that in order to avoid danger, to lessen pain, to save life, to gain pleasure, human beings are constantly performing acts the underlying principles of which they understand scarcely any better than a woodcock understands the principles of surgery. This difference between what may be expected of man and of a bird is probably one of the recondite features of Mr. Wheeler's animal psychology. If this 'serious student' means that action apparently or really intelligent on the part of animals implies scientific training and knowledge and accounts of such action are, therefore, to be contemptuously dismissed as 'untrue,' he has taken ground which he will undoubtedly be left to occupy alone. One wonders that he has not long since exposed Mr. Darwin. The books of the master naturalist are full of anecdotes that, according to Mr. Wheeler, must be discredited. For instance, there is the delightful one of the motherly baboon who stole young dogs and cats which she continually carried about. "An adopted kitten scratched this affectionate baboon, who certainly had a fine intellect, for she was much astonished at being scratched, and immediately examined the kitten's feet, and without more ado bit off the claws" ('The Descent of Man,' Chap. III.). Why does not Mr. Wheeler rise up and say that Darwin 'virtually claims' that the baboon was familiar with the 'Novum Organum' and the 'Positive Philosophy,' and further say that this anecdote is a specimen of the 'drivel in which animals are humanized beyond all recognition.'

The woodcock incident is further discredited because the naturalist was a lad of sixteen when it occurred. The editors of *Bird-Lore* seem to think that lads of fourteen or under are capable of making pretty good observations (see *Bird-Lore,* January-February, 1904). But this incident dates back twenty years, we are reminded. That the lapse of twenty years will certainly or even probably cause a 'distortion and exaggeration of the impressions' made on the mind of a boy of sixteen, even when the impression is exceptionally vivid, implies a theory of memory which is, perhaps, another peculiarity of the critic's psychology.

Finally, ridicule is heaped on Mr. Long because he presumes to bring forward a witness of what he believes to have been another case of animal surgery, and to give the credentials

of that witness. To those who have paid some attention to the nature of evidence it will be a matter of interest to learn, first, that additional witnesses and additional instances do not strengthen a case; and second, that the trustworthiness of witnesses is of no consequence. What a lot of bother men of science would have been spared if they had only known this before; for it is unnecessary to point out that the history of science abounds in accounts of efforts to gather evidence and to determine the weights of various pieces of evidence.

So far as the article 'Woodcock Surgery' affords a cross-section of its author's style of reasoning some of his universals seem to be: (1) Action that results in a causal correlation of antecedent and consequent is intelligent action in the sense that the agent understands the principles involved in the correlation; (2) any phenomenon which *B* has not witnessed *A* can not have witnessed; (3) unless an event is of common occurrence it can not occur at all.

Whom the gods wish to destroy they first lure into premises of this sort.

As regards the 'nature-study' classes in our schools, Mr. Wheeler may be spared that part of his anxiety which relates to the effect of such books as 'A Little Brother to the Bear' and 'Wilderness Ways.' One may well wish that every boy and girl in the land might become acquainted with Killooleet and Cloud Wings and Hukweem. Children and mere lovers of nature on the one hand, and comparative psychologists on the other, owe no small debt to men like William J. Long who have the patience and pluck to spend years in the wilderness home of birds and beasts in faithful observation of their life and habits.

Ellen Hayes.

THE PRESENT STATUS OF SOIL INVESTIGATION.

An address delivered on this subject before the Association of American Agricultural Colleges and Experiment Stations, November 17, 1903, and immediately published as Circular No. 72 of the University of Illinois Agricultural Experiment Station is discussed by Dr. F. K. Cameron in Science, February 26, 1904, page 343. Dr. Cameron states that the criticisms of his Bulletin 22 (Bureau of Soils) which have appeared are to the effect that the authors of the bulletin (Whitney and Cameron) 'have concluded that the use of fertilizers is of no value in affecting the yield of crops.' He further states that 'these criticisms have generally been copied from Circular No. 72, Agricultural Experiment Station, University of Illinois.'

As a matter of fact this statement does not occur in Circular 72, consequently, the objection to 'inexcusable carelessness of misquoting results and statements in a controversial paper' is strictly applicable to Dr. Cameron's own first paragraph. It is not believed that Cameron or any other theoretical chemist is so ignorant of agricultural science and practise as not to know that the use of fertilizers is of value in effecting the yield of crops. The statement in Circular 72 is that Bulletin 22 is commonly understood to teach that the use of fertilizers 'has little or no tendency toward permanent soil improvement, and that even the effect which they do produce is due very largely, if not entirely, to improved physical condition of the soil.' It is certainly safe to say that scientists and agricultural editors and practical farmers are all agreed that this is the teaching of Bulletin 22 regarding the use of fertilizers.

It will thus be seen that Doctor Cameron devotes much valuable space to a matter which is not pertinent to the discussion.

Both Bulletin 22 of the Bureau of Soils, Washington, D. C., and Circular 72 of the Illinois Experiment Station, Urbana, Ill., are available to the reading public, and consequently it is quite unnecessary and unreasonable to expect Science to reproduce any large part of those publications. The following direct quotation from page 59 of Bulletin 22 fairly illustrates its teaching:

> In the truck soils of the Atlantic coast where 10 or 15 tons of stable manure are annually applied to the acre, in the tobacco lands of Florida, and of the Connecticut Valley, where 2,000 or 3,000 pounds of high-grade fertilizers carrying 10 per cent. of potash are used, even where these applications have been continued year after year for a considerable period of time, the dissolved salt content of the soil as shown by this method

is not essentially different from that in surrounding fields that have been under extensive cultivation.

In England and in Scotland it is customary to make an allowance to tenants giving up their farms for the unused fertilizers applied in previous seasons.

The basis of this is usually taken at 30 to 50 per cent. for the first year, and at 10 to 20 per cent. for the second year after application, but *in the experience of this Bureau, there is no such apparent continuous effect of fertilizers on the chemical constitution of the soil.**

This quotation from Bulletin 22 is not referred to in Circular 72, but many other quotations are made which show this same general teaching and which Dr. Cameron now holds 'are utterly at variance with the complete context and plain meaning of the bulletin.' Of course, the 'complete context' can not be quoted here, but, so far as I am able to judge, this quotation, as well as all others which I have made, are fair samples of the accepted meaning of the bulletin as a whole.

In this connection attention may well be called to the fact that the above quotation is quite out of harmony with the statement on page 64 of Bulletin 22, to the effect that the conclusions of the authors are 'strictly in accord with the experience of good farm practise in all countries.' Probably there is no better farming practised in any country than in England and Scotland. After a full half century of agricultural investigation at Rothamsted Sir Henry Gilbert says,† regarding the effect of farm manure on certain plots of ground:

It has been seen that the unmanured plot has declined in yield and fertility; but there can be no doubt that the farmyard manure plot has, on the other hand, increased in fertility. *Analyses** of the surface soil at different periods *have shown** that it has become about *twice as rich in nitrogen** as that of the unmanured plot. It has, indeed, been shown that a large amount of the constituents of farm manure *accumulate within the soil.**

* Italicized by C. G. H.

† U. S. Dept. Agr., Office of Expt. Stations, Bull. 22, pages 149 and 150. (This most valuable bulletin written by the late Sir Henry Gilbert, himself, giving results of fifty years' investigation at Rothamsted, should be read by any one who reads Bulletin 22 of the Bureau of Soils.)

Again, Sir Henry says:

Referring first to the results obtained on the farmyard manure plot, the average annual produce over the [last] forty years was 34⅞ bushels, and over the fifty years 33½ bushels; in the one nearly 7 bushels and in the other 5½ bushels more than the average of the United Kingdom under ordinary rotation; in both not far short of three times the average produce of the United States, and more than two and one half times the average of the whole of the wheat lands of the world.

Without any manure whatever the average annual produce was 13 bushels over the [last] forty [years], and 13½ bushels over the fifty years.

Dr. Cameron apparently admits, as shown in Circular No. 72, that 'it has been possible on the basis of chemical analysis to advise the use of fertilizers containing potassium on certain Illinois soils with improved yield of crop,' but by the same system which he has so successfully applied in using strictly selected data from the Rothamsted experiments, he evidently overlooked the fact that on the same page of Circular 72 is shown an equally striking case where the chemical analysis of other soils plainly shows the need of nitrogen, the addition of nitrogen to these soils having increased the yield of wheat more than eight fold.

Regarding the use of potassium, however, Dr. Cameron adds:

A soil containing according to analysis an enormous amount of nitrogen (67,000 pounds per acre), an abundant amount of phosphorus (2,000 pounds per acre) but what is regarded as a deficient amount of potassium (1,200 pounds per acre) *produced no corn** when either nitrogen or phosphorus or both [or nothing] were applied; yield about the same, 36 bushels when *potassium,** 40 bushels when *potassium** and nitrogen or 38 bushels when *potassium** and phosphorus were applied. But when *potassium,** nitrogen and phosphorus were all applied, the indications of the analysis were flatly contradicted by a yield of 60 bushels.

This is, indeed, a most peculiar statement both chemically and otherwise. The 'indications of the analysis,' instead of being 'flatly contradicted by a yield of 60 bushels,' are thereby confirmed, for if sufficient potassium

* Italicized by C. G. H.

is applied to this soil, which already contains such an abundance of nitrogen and phosphorus, the yield should certainly rise to 60 bushels or more. Of course, there are reasons why the plots yielding 36 to 40 bushels did not yield 60 bushels instead of only 36 or 40. These reasons are fully explained in Illinois Bulletin No. 93, 'Soil Treatment for Peaty Swamp Lands.' Soils may all look alike to the theoretical chemist, but any one who is familiar with agricultural science and practise recognizes that there are differences in soils. Indeed, it seems pertinent to state that these differences were fully understood by the practical farmers who watched the experiments, and who are now using carloads of potassium salts with very great profit on these soils. In 1903 five plots not treated with potassium yielded 15, 7, 4, 5 and 4 bushels of corn, respectively; while five other plots, with potassium applied, yielded 73, 71, 73, 67 and 70 bushels.

All agricultural chemists will agree with Doctor Wiley's statement wherein he says: "When a man sends to me a specimen of a given soil and writes, 'Please analyze this soil and tell me what crops I can grow on it,' I send him word, 'Ask your soil itself what you can grow on it; in that way, asking your question directly of the soil, you can get your answer, and in no other.'"

Chemists recognize that soils have physical as well as chemical properties. On the other hand, no agricultural chemist of standing will agree with the statement of Whitney and Cameron, 'that a chemical analysis of a soil, even by these extremely delicate and sensitive methods, will in itself give no indication of the fertility of this soil,' understanding that the use of the word *even* is intended to convey the meaning that no other known methods need be thought of if these fail. Furthermore, it is certainly pertinent to the discussion to state here that Professor King, a recognized authority on soils and a careful and exact investigator, found that the chemical analysis of soils, *even by these methods*, furnishes much information regarding the fertility of soils. According to notes which I made from Professor King's address on the differences between some southern and northern soils in the United States, read before the Association of American Agricultural Colleges and Experiment Stations, he found that the northern soils contained 2.39 times as much water-soluble plant food as the southern soils and he also found that the yields of crops produced on the northern soils were 2.47 times the yields produced on the southern soils. This is in direct contradiction to the conclusions drawn by Whitney and Cameron from the very miscellaneous and discordant data reported in Bulletin 22. The investigation by Professor King and his assistants is evidently the most systematic accurate and valuable work which has yet been done by the Bureau of Soils; and it is certainly to be hoped that these investigations will soon be published in full, even though, being connected with the Bureau of Soils, Professor King can not 'anticipate the publication of the proceedings' of the Washington meeting.

The only just criticism of Circular 72 which Doctor Cameron makes in his ten-column article in SCIENCE is in regard to the statement concerning the methods employed by the Bureau of Chemistry in analyzing the Rothamsted soils. These statements were based on notes taken from the public discussion by the author of the *Journal* article* at the Washington meeting. Either Mr. Moore misspoke himself in saying 'fifteen hours' extraction' and 'gravimetric method,' or he said 'five hours' extraction' and 'volumetric method' and I misunderstood him; and I humbly accept Doctor Cameron's scathing rebuke for not having looked it up in the original paper. Cameron also insists upon having mention made of the twenty minutes allowed for settling in his water extraction.

The corrections suggested by Doctor Cameron being accepted the obnoxious statement regarding the work from the two bureaus on the same soil samples would then read as follows:

It will be observed that the Bureau of Soils by twenty-three minutes' extraction with distilled water at room temperature reports from two to thirteen times as much soluble phosphorus from

* *Journal American Chemical Society*, 24, 94 (1903).

these soils as the Bureau of Chemistry obtained by five hours' extraction with dilute acid of 40 degrees centigrade.

This correction will be made in the third edition of Illinois Circular No. 72. Analytical chemists will recognize how little force there is in this single just criticism in its application to the principles under discussion.

To illustrate his difficulty in finding suitable material for criticism, Doctor Cameron says:

> It is not at all clear why the phosphorus as determined in the two investigations should be compared on the basis of an acre surface with a depth of seven inches, for it is inconceivable that any one at this day, and in view of the well-known work of Darwin and others, would suppose that the same identical seven inches of soil would remain at the surface for any considerable period of time.

This criticism is neither pertinent nor consistent. First, it may safely be assumed that neither earthworms nor crawfish were active in these particular samples of soil during the interval between the two investigations, hence the criticism has no bearing on the point. Second, all results and comparisons reported in Bulletin 22 of the Bureau of Soils are based upon soil samples taken to certain depths; hence the critic is inconsistent. Reports of soil investigations which are written for the benefit of agriculture and agricultural people are best given on the acre basis, because this is the basis used in measuring crop yields, in applying manure, fertilizers, etc. The classic agricultural investigations of Lawes and Gilbert are practically all reported on the acre basis. Seven inches is a common depth for good plowing and this method of reporting results is in accord with the methods* adopted by the Association of Official Agricultural Chemists for collecting soil samples, which recognize that there are differences between soils and subsoils, whereas the arbitrary method of soil sampling, 0–12 inches, 12–24 inches, and 24–36 inches, in depth, as used by the Bureau of Soils (see pages 23–33 of Bulletin 22) commonly mixes surface soil and subsoil in one of the samples.

* U. S. Department of Agriculture, Bureau of Chemistry, Bulletin 67, p. 152.

While it is true that, in the early publication of his paper, Doctor Hilgard anticipated the proceedings of the Association of American Agricultural Colleges and Experiment Stations and of the censorship of the Bureau of Soils over the publication of those proceedings, it is also true that his arguments are unanswerable, as are, likewise, those of Director Hall of the Rothamsted Experiment Station, whose criticism of Bulletin 22 appeared in *Nature* last November, although it is entirely ignored by Cameron.

CYRIL G. HOPKINS.

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UNIVERSITY OF ILLINOIS.

SPECIAL ARTICLES.

ON A LEPTOCEPHALUS OF THE CONGER EEL.*

DURING late July, 1900, the first eel eggs taken outside of Italian waters were secured by the Fish Commission schooner *Grampus* on the surface of the Gulf Stream off Newport. The development of these eggs was described in the Bulletin of the U. S. Fish Commission for 1901.

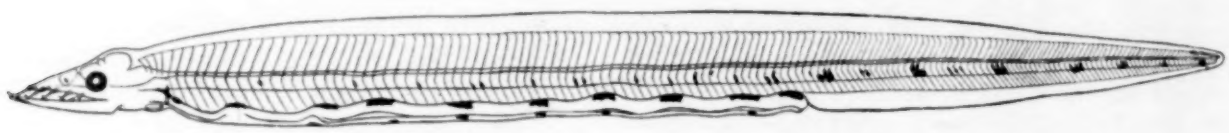
The largest larva reared measured about 11 mm. in length. The larvæ were characterized by the projecting lower jaw, the arrangement of the spots and the number of protovertebræ. Since writing the account which appeared in the bulletin the larvæ have been mounted on slides and a more satisfactory count of the protovertebræ made possible. There is still some doubt about the number of caudal protovertebræ. The count as near as it is possible to get it is $64+86$, $64+91$, $66+89$, $67+82$, $67+89$, $68+81$ and $70+86$ in seven larvæ.

On July 31, 1902, the *Grampus* collected a *Leptocephalus* 65 miles south of No Mans Land. It has a total length of 21 mm. and is undoubtedly the same species reared at Woods Hole in August, 1900. It agrees with the 1900 specimens in the projecting lower jaw, the general plan of the coloration, and has approximately the same number of protovertebræ. The protovertebræ are definitely 73 for the abdominal portion of the

* Contributions from the Zoological Laboratory of Indiana University, No. 54.

body and 82 or 83 for the caudal portion. The total number is, therefore, approximately equal to the total number found in the previous larvæ.

The coloration differs from that of the smaller larvæ in that additional spots have developed along the alimentary canal and along the sides. There are ten spots along the alimentary canal from the gill-openings to the anus. Most of these are duplicated



above and below, the upper one being the larger. There are seven or eight spots along the tail, not counting the color at the tip, which is apparently much as in the younger larvæ. There is a marked spot near the tip of the lower jaw and another on the upper jaw. There are in addition to these spots, which had representatives in the younger larvæ, a number along the sides over the notochord. In the anterior part of the body, the abdominal portion, these spots consist largely of a single chromatophore between two protovertebræ. Their arrangement on one side is as follows: No. 1 between the seventeenth and eighteenth protovertebræ; No. 2 between 28 and 29; No. 3 between 35 and 36; No. 4 between 39 and 40; No. 5 between 45 and 46; No. 6 between 51 and 52; No. 7 between 55 and 56; No. 8 between 61 and 62; No. 9 between 70 and 71. Those of the other side have a slightly different arrangement.

The spots on the tail have migrated up from the lower margin of the body so that they form a continuous series with those of the middle of the sides instead of with those of the alimentary canal. The last one of the caudal spots is, however, still located at the lower margin. Below it on the margin of the fin fold is a small spot, and there is a black stripe along the upper margin of the body at the base of the dorsal membrane, from a little in front of the last caudal spot to the end of the tail.

The size of this specimen indicates that it is about a month older than those previously described. The breeding season of this eel would, therefore, extend from about the middle of June to the end of July.

C. H. Eigenmann.

Indiana University.

ION ACTION.

It has long been the view of the writers that the term ion action in the sense that it has been used in pharmacology and physiology, is not justifiable and throws no light on the nature of salt action. It seems to have been accepted by many physiologists that the differences observed in the action of a series of analogous salts possessing, for instance, a common anion are to be attributed to a specific action of the cations upon the tissue. Such a conclusion seems to be unwarranted. Recent work on the catalytic decomposition of hydrogen peroxide offers a good example to illustrate our views. In a recent number of the *American Journal of Physiology* there appeared an article by Neilson and Brown* entitled 'The Effect of Ions on the Decomposition of Hydrogen Peroxide by Platinum Black.' After a study of the effect of a series of sodium salts and also a series of chlorides on the rate of the catalytic decomposition these authors conclude: 'In the catalytic decomposition of hydrogen peroxide by platinum black the cation, in general, has an inhibiting or depressing effect, and the anion has an accelerating effect.' We have recently shown† that the inhibitory action of certain salts on the catalytic decomposition of hydrogen peroxide by various metals is due to the formation of a thin insoluble film over the surface of the metal by the action of the salt on the metal. Thus it was shown that the catalysis by a given metal is inhibited by those salts whose constituent acid yields an insoluble salt with the catalyzer. Thus the catalysis by silver is inhibited by soluble chlorides, brom-

* *Amer. Jour. of Physiol.*, Vol. X., p. 225, 1904.

† *Amer. Chem. Jour.*, Vol. XXIX., p. 397, 1903.

ides and iodides, whereas fluorides do not inhibit the catalysis. It is to be observed that silver chloride, bromide and iodide are insoluble and that silver fluoride is soluble. This fact explains why chlorides, bromides and iodides inhibit the catalysis while fluorides do not, as in the latter case no insoluble coating can be formed. Silver cyanide is insoluble and hence hydrocyanic acid and the soluble cyanides inhibit the catalysis by silver. Thallium resembles silver in the solubility of its halogen salts, *i. e.*, the fluoride is soluble while the chloride and bromide are insoluble, and similarly soluble chlorides and bromides inhibit the catalysis by thallium while fluorides do not. Thallium differs from silver in that its cyanide is soluble and it was found that hydrocyanic acid has only a slight inhibitory action on the catalysis by thallium and this result is due to the fact that the metal is dissolved and hence the action of hydrocyanic acid on thallium is not at all comparable to its action on silver. Using freshly cut shavings of thallium the formation of the film on treatment with potassium bromide can be directly observed. On the other hand, hydrocyanic acid accelerates the catalysis by copper sulphate and ferrous oxide and also by finely divided copper and iron. It was found that if the salts of a given acid exert a retarding effect on the catalysis by a given metal the ammonium salt retards more than the corresponding sodium or potassium salt. This is also capable of simple explanation. Ammonium is a far weaker base than sodium or potassium, and is, therefore, more easily replaced by the catalyzer.

The ammonium salt thus lends itself more readily to the formation of a film. Thus the action of certain salts on the catalysis of hydrogen peroxide by metals is readily explained when we take into account the simple and well-understood chemistry of the substances with which we are dealing. It is true that the action of all inhibitors has not been explained as yet and in some instances undoubtedly other factors play a part, as has been found in the case of ammonium sulphocyanate. The action of accelerators is not as yet perfectly clear, but when the explanation is reached it will certainly take into consideration more the chemistry of each individual substance than the mere fact that they are in the ionic state. In general the sodium salts of the organic acids accelerate the catalysis. In our opinion the hydrolysis of these salts is to be taken into account as one factor in this acceleration, since the alkalies promote the decomposition of hydrogen peroxide and increase its instability. When we state that a thing is an anion or a cation we by no means exhaust the chemistry of the ion as seems to be sometimes inferred. An attempt to explain the action of inhibitors on the catalysis of hydrogen peroxide by metals in terms of the ionic theory as ordinarily employed in physiological work leads to conclusions that are entirely misleading. Thus ammonium chloride inhibits the catalysis by silver and thallium much more than sodium or potassium chlorides. To conclude from this that the ammonium ion is the inhibiting agent would be entirely erroneous. It is the chlorine in all cases that acts on the metal to form the film and the ammonium chloride inhibits the catalysis more strongly because the chlorine is less firmly held. To state from such facts that the cation retards the catalysis would neither be expressing a fact nor offering an explanation of the supposed fact. In a subsequent publication* Neilson and Brown make the following statement: 'In our work on the effect of ions on the decomposition of hydrogen peroxide by platinum black, we obtained results which may be explained by the assumption that in general the anions exert a stimulating action, and the cations a depressing action, so that the action of a given salt depends on whether the anion or cation is the more powerful.' The writers fail entirely to see the slightest suggestion of an explanation.

It seems to be true that most chemical reactions occur between substances in the ionic state, and the necessity of the presence of water for many chemical reactions has led some chemists to assume that chemical interaction only occurs between ions. This is still an open question. Even in so simple a case

* *Amer. Jour. of Physiology*, Vol. X., p. 336, 1904.

as the hydrolysis of cane sugar by acids, an action which has been studied so carefully and been found to be proportional to the number of hydrogen ions, it is not proved that the hydrolysis is due to the hydrogen ion independently of the anion, and it seems most improbable to the writers that such is the case. The monatomic ions differ from atoms only in the possession of an electric charge. Hence ion action can only differ from atomic action in consequence of this charge. The writers have been unable to find any evidence in physiology or pharmacology that an ion ever effects a functional change in consequence of this charge. Such a demonstration would be heartily welcomed. The expression ion action in the sense in which it is so often used in physiological literature seems unwarranted.

It must be added that the brilliant results which have been attained in the field of salt action are in no way affected by whatever explanation they may ultimately receive.

A. S. Loevenhart,
J. H. Kastle.

DEATH GULCH.

It is certain that nowhere within a like area can be found so many natural features of greatest interest as those to be seen in the Yellowstone National Park.

Not the least of these is Death Gulch, discovered in 1888 by Walter Harvey Weed, of the United States Geological Survey.

Mr. Weed's description of his discovery appears in Science, February 15, 1889, and contains information concerning geological features, comparisons with the Death Valley of Java and other matters of general interest.

At this time bodies of five bears, one elk, many small mammals in various stages of decomposition, and numerous insects were found. None of the animals showing signs of violence, Mr. Weed concluded death was caused by poisonous gas.

In 1897 Dr. T. A. Jaggar, Jr.,* visited the gulch, finding the carcasses of seven grizzlies and one cinnamon bear.

Tests made at various places along the bottom of the gulch failed to show sufficient gas to extinguish the flames of burning matches.

A year or two later Capt. H. M. Chittenden visited the gulch and found no animal remains nor any evidence of noxious gases.*

This experience caused him to express considerable doubt as to the authenticity of previous accounts.

As both Weed and Jaggar have indicated, the gulch is of such a nature, it is almost certain to be cleaned out periodically by freshets resulting from melting snow or heavy rains.

Quoting from the journal of the corporal in charge of the Soda Butte Station, the following extract needs no comment.

May 3, 1898.—Lt. Lindsley and Corpl. Herb left station for Cache (Creek). Followed trail to Death Gulch. Crossed Cache Creek at Death Gulch and patrolled two gulches to find the one in which supposed skeletons were to be found. Run into a bear track and in following it, came to Death Gulch. Corporal Herb went into it to the bottom and counted seven bear, brown silver-tip and one grizzly. Part of gulch covered with snow. Signs of bear abundantly on both sides. The smell is that prevalent throughout the sulphur regions of the park. On being in the bottom of the gulch the sensation experienced was that of dizziness leaving a headache behind.

May 28, 1898.—Pvts. Root, McDonald and Edwards, mounted to Death Gulch. Counted carcasses of seven bear and one fox. Saw fresh signs of large bear on east side of gulch.

August 10, 1902.—Pvt. Wilson from station to Death Gulch, found carcass of bear having recently died, probably within twenty-four hours.

It has been my good fortune to visit Death Gulch, three different times. The first in 1900 when returning from Hoodoo Basin, our party camped near the mouth of Cache Creek and visited the gulch. We counted the carcasses of four large bears, and saw the remains of many other animals, represented mainly by bones with occasional tufts of hair. At this time the smell of sulphureted hydrogen was noticeable, and I determined then to learn, when possible, the composition of the gas of the gulch.

With this end in view, I went to the park in June of the past year, with apparatus for the analysis of gases.

* *The Popular Science Monthly*, February, 1889.

* 'The Yellowstone National Park,' fourth edition, p. 335.

Upon reaching Soda Butte Creek, however, I found the waters too high to permit safe fording with a wagon, and had to be content with a horseback ride to the gulch without my apparatus. The only fresh animal remains I then found were those of a small bear which I supposed was the bear Corporal Wilson, of Soda Butte Station, had discovered the preceding year. The smell of sulphureted hydrogen was very strong, and later I noticed the silver coins I had in my trousers pocket while in the gulch were much tarnished.

In August we were successful in getting the apparatus over to the gulch. The wind was blowing at a fair rate during all the time we were in the gulch, and occasional sharp showers of rain occurred.

Notwithstanding the extremely favorable conditions for the rapid diffusion of gases, the air near the bottom of the gulch showed the presence of more than ten per cent. of carbon dioxide, and strong traces of sulphureted hydrogen. A search for the outlets of the gas showed fissures on the *sides* of the gulch from which the gas literally poured.

One crevice in particular, an opening about fourteen inches long by four inches high, furnished so much gas we decided to analyze it, and found a little over one per cent. of sulphureted hydrogen, and more than fifty per cent. of carbon dioxide, and we have reason to believe the percentage of these gases was even higher than these figures, for there were several ways in which the air, constituting the remainder of the sample, may have entered the bottle. But these results show how, upon still days when gaseous diffusion is not very active, a sufficient percentage of gases to cause death might remain mixed with the air along the bottom of the gulch.

The question of sulphureted hydrogen poisoning has not been very carefully studied, and it is difficult to obtain any reliable data concerning it.

The following translation, however, gives some information on this point:*

> Lehman states that when the proportion of sulphureted hydrogen in the atmosphere reaches one to three parts per thousand, animals die in it in ten minutes, with apoplectic symptoms and great difficulty in breathing.
>
> An atmosphere containing one half part per thousand sulphureted hydrogen produces death with cramps and œdemic inflammation of the lungs.
>
> It further produces rhinitis, conjunctivitis and laryngitis.
>
> It may be characterized as a blood poison which decomposes the oxyhæmoglobin in the body to sulphmetahæmoglobin.

It may be concluded, then, that about one tenth per cent. in air is a sufficient amount to produce fatal results. This percentage would be reached by the dilution of the gas issuing from the fissure to ten volumes, which, considering the large quantity coming from this and similar fissures, would require a very large volume of fresh air. This dilution would reduce the carbon dioxide to five per cent., which would be considered generally a dangerous quantity.

Another interesting point in connection with the question of the poisonous effects of sulphureted hydrogen gas is that concerning its effect when associated with large amounts of carbon dioxide.

Would it not, for several reasons, be more dangerous, when associated with five per cent. of carbon dioxide? This phase of the question deserves careful investigation.

At the time of my last visit we found the remains of one small bear, the one I had noted in June, another bear, elk hides, three birds, including a mountain blue jay and a great horned owl, numerous old skeletons not identified, beetles, moths, butterflies, flies and maggots.

It is interesting to note, in respect to the dead maggots, the intermittent action of the gas. After the death of the bear on which they were found the atmosphere permitted the presence of flies which laid their eggs on the carcass. Maggots developed, lived for a time, until the gas became sufficiently strong to kill them.

Flies were flying about the gulch while we were carrying on our work. Some of these we caught and held in the escaping gas from the crevices. In each case death occurred on six seconds' exposure to the gas.

* 'Toxikologie für Thierärtze,' Eugene Fröhner, 2d ed., pp. 146, 147.

The slope from the bottom of Death Gulch from the mouth upward is very great, affording a hard climb for any who may attempt to pass up it. Occasionally, shelves are encountered adding to the difficulty of reaching the place where the animals are found. It is above one of these shelves or steps where all of the carcasses were lying, and the floor of the gulch at this place is comparatively level for a distance of twenty feet or more. At the upper end of this space and about four feet up the side is the fissure described. You may see this offers a fine opportunity for the accumulation of gas.

Thinking of the preservative effects of the gas, I believed at first the bear discovered by 'Pvt. Wilson' was the one I found the following June but later learned that the former was a large bear from which the claws had been taken by the soldiers, while the latter was a small bear still retaining its claws.

Water flowing in the upper part of the gulch has a distinct acid reaction. One determination showed the acidity calculated to sulphuric acid to be equal to one third of a gram to the liter. This acidity disappears before the lower part of the gulch is reached, a sample half way down from the top giving a neutral reaction.

The production of gas is probably connected with this neutralization of the acid water. The action of the acid on carbonates and sulphides liberates the gases.

The symptoms experienced by members of our party while in the gulch were not those of asphyxiation, the usual result of the action of carbon dioxide, but while no two were affected exactly alike, dizziness was noted in each case. In addition to dizziness one had nausea, another headache and the third was dizzy but noticed no other effect.

Taken altogether, the phenomena of this region are most interesting and deserve further study. In taking samples of the gas it was necessary to watch the flow of acidulated water containing cadmium sulphate, in which the sulphureted hydrogen was collected, to see that none of the precipitated cadmium sulphide was siphoned off.

Bending over watching this intently I was almost overcome by the gas, and but for the assistance of my friends in getting to fresh air I should have remained with 'Wahb' and his brethren at the bottom of Death Gulch.

F. W. Traphagen.

Montana State College,
Bozeman, Montana.

A LOACH FROM NANAIMO.

Through the kindness of Mr. Jaeger, of Brannan St., San Francisco, Stanford University has received a live specimen of a very mysterious fish. It is a loach, an eel-shaped fish with the head of a sucker and the beards of a cat-fish, a group of fishes abundant in the Old World in the brooks from Ireland to Japan, but never before found in America.

The loaches are very hardy, as much so as a salamander, and they sometimes come out into the wet grass in search of insects.

This loach was brought to San Francisco in a coaling ship from Nanaimo. He was said to have been found in a puddle in the coal-bank. He was put into a tumbler of water at San Francisco, and then revived. When I found him he was still in the glass of water and lively enough, the bottom of the glass being covered with coal dust.

His origin is a puzzle. Some patriotic Englishman might have brought a loach to Nanaimo. Some Chinaman may have carried about a live loach as good medicine. Some Japanese may have had him in his little tray-garden. It is not easy to conceive that this family should be native to America and that we should have overlooked it so long, while describing so many Asiatic and European species.

This loach has six barbels, short dorsal, a rounded caudal. It can not, therefore, belong to any one of the three European genera. Its place is in the genus *Orthrias*, lately framed by the writer for a species from northern Japan. But the new loach is not this species, nor does any one of the few Chinese species of *Orthrias*, of which I find accounts, resemble it very much.

This is clear. The loach from Nanaimo belongs to a new or rare species. It is either native to Vancouver Island or else it has been brought over alive from China. Meanwhile

the type cheerfully lives in the aquarium, feeding on mosquito larvæ and little tadpoles. Who will find a second specimen?

DAVID STARR JORDAN.

QUOTATIONS.

THE DEPARTMENT OF AGRICULTURE.

THERE is grumbling all the time on account of the continually increasing demands of the Department of Agriculture. For the fiscal year 1897–98 its appropriation was $3,182,902. For the current year the appropriation is $5,478,160, and the department will cost $6,229,880 next year.

Although the amount spent by the department is large, other countries are expending proportionately more each year for the same purposes. The latest obtainable figures, as given in a recent report from the senate committee on agriculture and forestry, show these to be the appropriations of several foreign countries for the encouragement of agriculture:

France	$ 9,020,000
Austria	9,275,000
Hungary	9,400,000
Russia	25,280,000
Japan	3,750,000

In order that these figures may mean something, the committee has calculated the amount spent by each nation, including the United States, for each acre of tillable land and for each person in the agricultural population. These figures are:

EXPENDITURE PER ACRE OF AGRICULTURAL LAND.

	Cents.
France	9.8
Austria	13.3
Hungary	12.4
Russia (about)	4
United States	1.3

EXPENDITURE PER CAPITA OF AGRICULTURAL POPULATION.

	Cents.
France	52
Austria	69
Hungary	90
United States	35

Russia, with an area of 8,660,395 square miles, maintains 102 experiment stations, or one to every 84,906 square miles. The United States, with 3,692,125 square miles, has sixty experiment stations, or one to every 61,535 square miles. The other extreme is reached with Belgium, where, in a country containing 11,373 square miles, fifteen experiment stations, or one to every 758 square miles of territory, are maintained. Germany and France maintain a station for every 3,000 square miles of their territory, roughly. In no section of the United States are there as many stations in proportion to the land surface as there are in Germany and France. In the states on the Atlantic seaboard there is one station to every 24,000 square miles of land. Texas, with one federal experiment station, is 27 per cent. larger than all of France and Germany, with their 151 stations. The ratio of experiment stations to area in France and Germany is 96 to 1 as compared with Texas, 28 to 1 as compared with Minnesota and the Dakotas, and 39 to 1 as compared with our Pacific states.

The quarrel that the public has with the Department of Agriculture does not hinge on the amount of its annual appropriation. There has never been any disposition to treat it in a niggardly fashion, but the impression is general that great sums of money are wasted on frivolous enterprises.

The free distribution of seeds is the most notorious of the improper expenditures of which the system is guilty, and the amount of money involved in this is about the same as the annual increase in the appropriation granted by congress. The Weather Bureau, which costs the department $1,330,000 a year, is pretty generally laughed at now.

If the department devotes itself to its legitimate business, and accomplishes its functions properly, it will not be hampered by any lack of funds.—The N. Y. *Sun*.

JAMES HYATT.

DR. JAMES HYATT died at Bangall, N. Y., on February 27, in the eighty-seventh year of his age. He was one of the earliest members of the American Association for the Advancement of Science, also a member of the New York Lyceum of Natural History, now the Academy of Sciences, and one of the founders of the Torrey Botanical Club. With him

passes away one of the last representatives of the early pioneers in scientific work in old New York. To the labors of this group of men, among whom were Professors Wood and Torrey, we owe many of our privileges to-day in the scientific world. Dr. Hyatt averaged during the years between 1860 and 1870 twenty lectures a week in sixteen schools and colleges, besides holding the chair of chemistry and toxicology in the Woman's Medical College. He was the author of 'First Lessons in Chemistry,' published in 1839, and 'The Elements of Chemistry,' published in 1856. At the time of his death he was a volunteer observer of the Weather Bureau. It is well that we honor the memory of these pioneers. It was they who fostered the spirit of learning and the love for science when the humanities alone were thought worthy of the attention of those who sought education. To their labors and their foresight we owe our great scientific societies and associations which exercise so potent an influence on the thought and activities of the educational world of to-day.

John J. Schoonhoven.

HANS HERMANN BEHR.

There died in San Francisco, March 6, 1904, Dr. Hans Hermann Behr, in his eighty-sixth year. His work belonged to the preceding generation; for though the brightness of his intellect was undimmed to the last, yet the feebleness of his body prevented his doing scientific work during the last years of his life, when his position as curator of the Entomological Department of the California Academy of Sciences gave him leisure. His large and valuable collection of lepidoptera is in the possession of the California Academy of Sciences and contains, besides his own types of California insects, duplicates of the types of Xantus and Boisduval and others. The collection is cosmopolitan and is probably the most complete collection of Californian lepidoptera in existence. He attended the universities of Halle and Würtzburg, but took his degree from the University of Berlin. He numbered among his friends some of the leading scientific men of the age, Alexander von Humboldt, Virchow, Schlechtendahl, Naumann, Garmar, Ferdinand von Mueller, Dr. Hillebrand, Louis Agassiz, Max Müller and others.

For many years he was professor of botany at the California College of Pharmacy and he wrote two little books on the 'Flora of San Francisco' to assist the students. The 'Introduction' to the earliest 'Local Flora' shows that he was abreast if not ahead of his time, and also gives an original outline of the system of classification showing a complete grasp of the orders of plants that is very rare. He kept no record or copies of his publications, and it would be a work taking some time to unearth them from the German and American periodicals where they appeared.

He was a many-sided man, wrote German poems of beauty and genuine feeling, wrote a story of life in the Philippine Islands which was published in the *Atlantic Monthly*, and a novel of life in California published in a German magazine. He understood every language of Europe. Greek and Latin were about as familiar to him as English and he could quote from the classics indefinitely. He was a purist in the formation of scientific terms, and such words as 'cotype' and a genitive like 'Salmonorum' aroused his contempt and wrath. During his early manhood he was a deep student of Sanscrit and he learned Hebrew when a boy. He was one of the early members of the now famous Bohemian Club of San Francisco. The papers which he wrote for the amusement of the club have been lately collected and published under the title of 'The Hoot of the Owl,' to amuse and charm every one with their quaint and original humor.

Alice Eastwood.
California Academy of Sciences.

SCIENTIFIC NOTES AND NEWS.

President Carroll D. Wright has decided not to call a spring meeting of the council of the American Association for the Advancement of Science, in view of the fact that there seems to be no business of sufficient urgency to warrant it.

Dr. Simon Flexner, director of the Rockefeller Institute, New York, has been elected

president of the American Association of Pathologists and Bacteriologists.

A COMMITTEE appointed in connection with the celebration of President Eliot's seventieth birthday has decided to invite Mr. John Sargent to paint a portrait of President Eliot.

A COMPLIMENTARY dinner is to be given this week to Rear Admiral George W. Melville, U.S.N., by the Institute of Naval Architects of Great Britain. The organizing committee includes the Earl of Glasgow, Lords Brassey and Inverclyde, Admiral the Right Hon. Lord John Hay, dean of the British Navy; Sir William White, chief constructor; Admiral Durston, engineer-in-chief, and Admiral Hopkins.

DR. L. O. HOWARD, chief of the division of entomology and permanent secretary of the American Association for the Advancement of Science, has been elected a foreign member of the Société Nationale d'Agriculture de France.

GENERAL BASSOT has been appointed director of the Observatory at Nice, in the place of the late M. Perrotin.

DR. J. N. LANGLEY, F.R.S., professor of physiology at Cambridge University, has been given the degree of doctor of laws by St. Andrew's University.

THE council of the Royal College of Surgeons in Ireland has adopted the following resolutions: "That the president, vice-president and council express their gratification at the appointment for the first time of a medical man to the office of provost of Trinity College, and congratulate Dr. Anthony Traill on his appointment to that distinguished position."

PROFESSOR E. B. WILSON, of Columbia University, will spend the summer at the Naples Zoological Station.

PROFESSOR C. S. SHERRINGTON, of Liverpool University, will open his course of Silliman lectures at Yale University on April 22.

THE subjects of the Herter lectures being given this week at the Johns Hopkins University by Professor Paul Ehrlich are: (1) 'The mutual relations between toxine and antitoxine'; (2) 'Physical chemistry versus biology in the doctrines of immunity'; (3) 'Cytotoxines and cytotoxic immunity.'

UNITED STATES AMBASSADOR TOWER, on April 7, presented the New York Geographical Society's Cullom medal to Dr. George von Neumayer, director of the Hamburg Nautical Observatory, for distinguished services to science and especially for the discoveries which he made in his expeditions to Australia.

THE Council of the Royal Geographical Society has decided to award the two Royal Medals for this year to Sir Harry Johnston, well-known for his discoveries in Africa, and to Commander R. F. Scott, R.N., who is returning from the Antarctic regions. Two of the other honors at the disposal of the council have been awarded for Antarctic work. One of these, the Murchison grant, has been awarded to Lieutenant Colbeck for his services while in command of the relief expedition. It will probably take the form of a silver globe, designed by the president, showing the route of the expedition. It has been decided to present the Gill memorial to Captain Irizar, of the Argentine navy, for his rescue of the Nordenskjöld Antarctic expedition. The Cuthbert Peek grant will be presented to Don Juan Villalta for geographical discoveries to the east of the Andes while in command of a Peruvian exploring expedition; and the Back grant to Dr. M. A. Stein for his geographical work in Central Asia, and especially for his mapping in the Mustaghata and Kuen Lun ranges.

THE Carnegie Institution has made a grant of $500 to Professor Henry S. Carhart, of the University of Michigan, to be used for the determination in absolute measure of the electromotive force of Clark and Weston standard cells, and for the determination of the electrochemical equivalent of silver. Professor Geo. W. Patterson, Jr., is engaged with Professor Carhart in this work.

MR. WILLIAM CAMPBELL, of the department of metallurgy of Columbia University, has been granted $1,500 by the Carnegie Institution for a study of the effect of heat treatment on the microstructure and on the physical properties of iron and steel.

THE legislature of Porto Rico has appropriated the sum of $5,000 to defray the expenses of an investigation into the prevalence

of ankylostomiasis in the island. The investigation is to be conducted by Captain Ashford, of the Military Hospital.

Commander Thomas Arthur Hull, a recognized authority on nautical surveying and navigation, at one time superintendent of charts in the British hydrographic department, died on March 25 in his seventy-fifth year. The death is also announced of Professor Emile Laurent, the Belgian botanist.

Ground has been broken at Cold Spring Harbor, Long Island, for the new building to be erected for the station of experimental evolution of the Carnegie Institution, of which Professor Chas. B. Davenport is the director. The structure will be 65 x 35 feet, of brick covered with stucco, two and one half stories high. It will take about two months to complete the building. It will be located in a field a short distance north of the state fish hatchery buildings, and about an equal distance south of the laboratory of the Brooklyn Institute of Arts and Sciences.

The decision of the American Society of Civil Engineers not to join the other engineering organizations in accepting Mr. Andrew Carnegie's offer of a new building on Thirty-ninth and Fortieth Streets, New York, has been followed by the announcement that the society had completed a real estate purchase which will make possible the enlarging of its clubhouse on Fifty-seventh Street to twice its present size. The society has bought the lot on the south side of Fifty-seventh Street, 140 feet east of Broadway, immediately adjoining its building on the west. Plans will be prepared immediately for extending the structure over this lot, which has a frontage of 25 feet and a depth of 114 feet. The exterior of the new addition will be made to conform with the present building.

The Peary Arctic Club has been incorporated. The incorporators state they desire to associate themselves together to promote and maintain explorations in the Polar Sea, headed by Lieutenant Peary, and to provide funds for the same.

The subject for the Sedgwick prize essay, at Cambridge University, for the year 1906 is 'The characters, geographical distribution, sources and mode of transport of the boulders of the Cambridge district.' The essays must be sent in to the Registrary on or before October 1, 1905. The prize is open to all graduates of the University of Cambridge who shall have resided sixty days during the twelve months preceding the day on or before which the essays must be sent in.

To inaugurate the opening of the Simplon Tunnel an exposition will be held at Milan from April to November, 1905. Special prizes will be given for air navigation. It is to be international, except for the fine arts, which will be exclusively national.

It is announced that an association of English manufacturers has chartered the steamer *Lake Megantic,* belonging to the Canadian Pacific Railway Line, for a trip around the world with an exhibition of British goods and manufactures. She will leave London April 27 and be fitted out with samples of goods manufactured by the best British industrial firms. She will make her first call at Halifax, and from here go to St. John's, Newfoundland, and afterwards to Canadian ports. From Canada the exhibition will sail to the West India Islands, thence to South Africa, and thence to Bombay via Mauritius. From Bombay, Colombo, Madras, Calcutta and Rangoon will be visited; then, sailing by Penang through the Straits of Malacca, touching Singapore, the exhibition will visit Hongkong, Shanghai, Nagasaki and Yokohama, sailing thence to Australia and New Zealand. Homeward, the vessel will call at Buenos Ayres, Montevideo, Rio de Janeiro and West Africa.

We learn from the London *Times* that the International Marine Association, of which the president is M. Charles Roux, has issued the program of its fourth congress, which is to be held in Lisbon from May 22 to May 28. Among the topics which are to be discussed under the general head of oceanography and hydrography are bathymetric charts and the latest cruise of the Prince of Monaco's yacht. The question of North Atlantic weather forecasts will be considered, as also the various conventions for the unification of all matters connected with navigation on the high seas and the treatment of vessels in foreign ports.

The question of the improvement of ports by the installation of practical appliances is deemed so important that it has been given in the program under a separate heading. The Panama Canal, sailors' charitable associations, territorial seas, international marine statistics, yachting, sardine fisheries and wireless telegraphy also figure in the list of matters to be dealt with.

THE London *Times* states that Sir Alfred Jones entertained at lunch, in Liverpool, on February 22, a company of merchants and scientists to meet Professor Boyce on his return from Egypt, and to hear his statement as to the success of the anti-malarial fever expedition to Ismailia. Sir Alfred Jones presided and welcomed Professor Boyce. Professor Boyce said that when Major Ross visited Ismailia in September, 1902, there were 2,000 cases of malaria annually in a population of 9,000 people, of whom 2,000 were Europeans. The authorities at Ismailia loyally carried out Major Ross's suggestions as to filling up marsh land close to the town and cleaning out small irrigating channels and stagnant waters. That involved an expense of £4,400, and at the same time they organized a drains brigade and petroleum brigade, as a result of whose work people could now sleep in any of the houses in the European quarter without mosquito nets. From something like 2,000 cases of malaria a year the number had been reduced, according to the latest statistics drawn up by an independent medical officer, to 200. As a matter of fact, there were no fresh cases of malarial infection in Ismailia; there had been no deaths among Europeans during the year, and only four among natives, against something like 30 deaths the year before. Such had been the improvement that Prince D'Arenberg, president of the Suez Canal Company, informed him that he hoped before two years were out to see Ismailia regarded as the sanatorium and watering place for Cairo. Tropical medicine was bringing us to think that after all this little country of ours had been for centuries teaching medicine applicable to our own country and domestic life without thinking of our great empire all over the world. The time had come when they must teach students a medicine applicable to the whole world. Major Ronald Ross, C.B., remarked that the success of the anti-malarial campaign at Ismailia had taught two things —that it was possible to rid a large town entirely of mosquitoes, and that it was equally possible to eradicate malaria. He had been asked by Mr. Brodrick to draw up a report as to malaria cases in India, which numbered 300,000 admissions to hospitals among the troops and the gaol prisoners. With the Ismailia figures before him he would do that with complete confidence, for he was sure that very shortly they would reduce that immense admission rate to one third of its former number.

WE learn from *Nature* that a bill for rendering compulsory the use of the metric system of weights and measures in the United Kingdom was read a second time in the House of Lords and referred to a select committee. The bill provides that the metric system shall become compulsory on April 5, 1906, or at such later date as may be directed by His Majesty by order in council. It is, therefore, left to the discretion of the government to fix the date for inaugurating the compulsory adoption of the system. In moving the second reading of the bill, Lord Belhaven referred to the recommendations of the select committee of the House of Commons in 1895, and pointed out the educational and commercial advantages which would follow the adoption of the metric system in the place of our present irrational standards. Lord Kelvin, speaking in support of the bill, remarked that in Germany, France and Italy, no inconvenience had resulted from the introduction of the metric system. He said it was of interest to know that the decimal system originated in England. In a letter dated November 14, 1783, James Watt laid down a plan which was in all respects the system adopted by the French philosophers seven years later, which they suggested to the King of England as a system that might be adopted by international agreement. James Watt's objects were to secure uniformity and to establish a mode of division which should be convenient as long as decimal arithmetic

lasted. Speeches in favor of the bill were made by Lord Wolverton, the Marquis of Lansdowne and the Earl of Rosebery.

UNIVERSITY AND EDUCATIONAL NEWS.

Mr. John D. Rockefeller has given $500,000 to the Johns Hopkins Hospital, in order that the work of the institution may not be curtailed owing to the losses from the recent Baltimore fire. The Maryland legislature has voted $25,000 annually for two years to the Johns Hopkins University.

By the will of Mrs. Farnham, widow of the late Professor Henry Farnham, Yale University receives $52,500 for the endowment fund of the medical school and $39,000 for the endowment fund for the library.

The Goldsmiths' Company has transferred to the University of London the technical institute in South London which it has maintained for the last twelve years. The value of the buildings and land is estimated at about $500,000. As work of the kind that the company had been doing will henceforward be paid for by public funds, the institute has been made over to the University of London for higher education.

The London *Times* states that the physiological laboratory committee of London University has presented a report upon the work done in the laboratory during the past two years. This institution was established in February, 1902, to provide facilities for original work in physiology and experimental psychology, and to publish by means of lectures to advanced students the results of recent work in this branch of study. For the establishment and maintenance of the laboratory the senate are chiefly indebted to Mr. Walter Palmer, M.P., Mr. Alfred Palmer, and Mr. G. W. Palmer, M.P. During the past two years eleven courses of eight lectures each have been delivered in the laboratory, and arrangements have been made by the senate with Mr. John Murray for the publication, under the authority of the university, of such of these courses as may be from time to time approved. The first volume published in this series has been Dr. A. D. Waller's 'On the Signs of Life.' The laboratory has been used for various researches by 20 qualified students, and 23 communications from persons working in it have been published in the *Proceedings of the Royal Society* and other scientific journals.

The Messrs. Mallinckrodt, of St. Louis, have agreed to pay $500 to a chosen student of chemistry in the graduate school of Harvard University during the year 1904–1905, on condition that this student contract to serve in the Mallinckrodt Chemical Works during the year 1905–1906 at a suitable salary.

Boston University is about to establish a scientific department in the College of Liberal Arts, and has appointed in this department A. W. Weysse, A.B., Ph.D. (Harvard), now of the Massachusetts Institute of Technology, to be assistant professor of biology, and L. G. Newell, A.M. (Brown), Ph.D. (Johns Hopkins), now of the State Normal School at Lowell, to be assistant professor of chemistry.

George M. Stratton, A.B. (California), Ph.D. (Leipzig), associate professor of psychology in the University of California, has been appointed professor of experimental psychology in the Johns Hopkins University.

Dr. R. G. Van Name has been appointed to an instructorship in chemistry at Yale University.

Professor William O. Emery has been appointed head of the chemical department and director of the chemical laboratory in the New Mexico State School of Mines. Dr. Emery was for ten years instructor and docent in the Universities of Berlin and Bonn. He was later connected with the University of Chicago, and professor in Wabash College.

Professor H. E. Crampton, of Columbia University, will take charge of the work in embryology at the biological laboratory at Cold Spring Harbor.

Dr. Rothpletz has been made professor of geology and paleontology at the university of Munich, in the room of the late Professor von Zittell.